

The Mining Journal

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How Much Copper?

THE renewed confidence regarding the long term outlook for copper expressed by Sir Ronald Prain, at the informal shareholders' meeting of the R.S.T. group of copper companies in London last week, will no doubt have reassured many of those who have in recent months been expressing anxiety regarding the erosion of copper's traditional markets by, in particular, aluminium and plastics. Sir Ronald forecasts that provided copper does not rise to a level which would lead to substitution, and he is known to regard an average figure of £240 with a fluctuation of not more than 10 per cent on either side as "safe", and provided that the present level of prosperity continues, we can anticipate the present excess in production capacity will persist until about 1963 with a rough balance being achieved in 1964.

How does this statement look in round figures? According to recent *E. and M.J.* estimates, Free World production capacity (making no allowance for strikes or stoppages) will amount to 4,650,000 s.tons by 1964. With scrap likely, by then, to account for perhaps another 750,000 s.tons, about 5,400,000 s.tons would thus have to be accounted for by then to achieve balance. Free World consumption plus Iron Curtain imports are at present running at about 4,300,000 s.tons or 1,100,000 s.tons less than capacity in 1964.

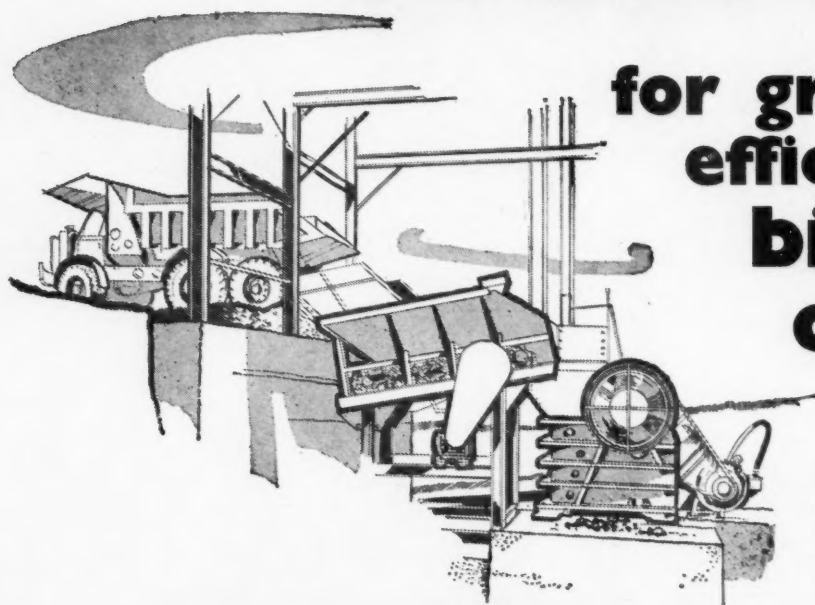
Sir Ronald is known to anticipate an average annual consumption growth over the next few years of 4.6 per cent (slightly more than the average in the years since the end of the Korean war) which points to a total consumption of 5,150,000 s.tons in 1964 without making any allowance for increased exports to Communist countries. On this basis, and assuming that we continue to have our usual quota of industrial disputes in the industry, balance by 1964 is thus not an unreasonable hope.

The crux of the matter is, however, the assumption of a 4.6 per cent rate of growth as compared with an average annual increase of 3.9 per cent for the post war period 1948 to 1959. As Mr. James F. McDivitt pointed out in these columns last week ("The Changing Market for Metals" pp. 378-81) the vital question now overhanging the copper industry is whether the growth in copper usage is more apparent than real, and how far world consumption statistics mask the onset of diminishing *per capita* consumption, actual or prospective, in the more highly industrialized countries. It seems likely that by 1964 we may know the answer.

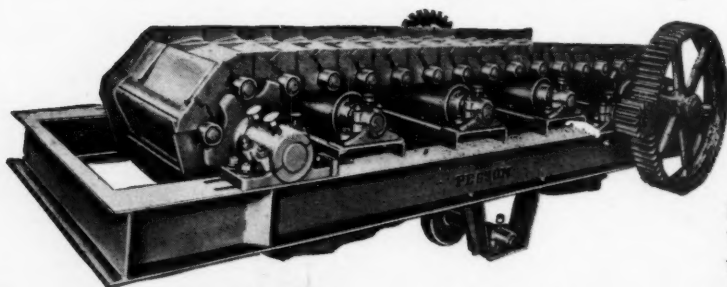
If the balance between full scale supply and consumption is to be reached as early as 1964 (after allowing for increased facilities to come in meanwhile such as the 50 per cent increase in Mufulira production during 1962), it is perhaps pertinent to ask what other new projects are currently under development, which will be ready in time to meet expanding demand in the middle sixties. If the answer to this gives any cause to fear a subsequent shortage of supply which might threaten the maintenance of a

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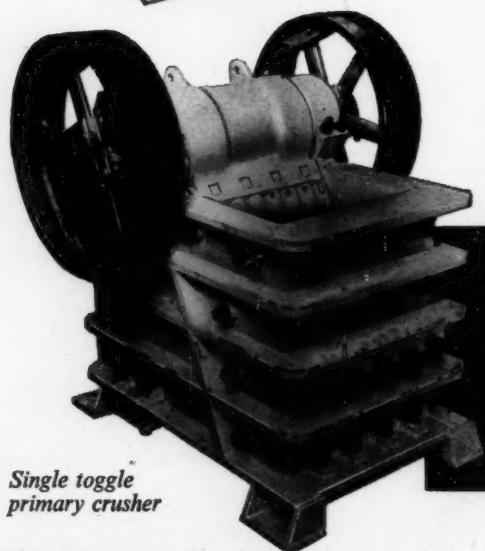
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stable copper price, so essential to consumer confidence, then the protagonists of the production cutback, as distinct from sales cutbacks allied to producer stockpiling, may well have cause to think again while the excess production is there for the having.

Meanwhile, despite the production cutbacks which have been initiated in one way or another by most of the bigger producers, consumption is currently running at about 150,000 s.tons a year below actual production and probably close to 500,000 s.tons below full capacity production. In view of what appears, at least for the moment, to be a somewhat more reassuring political picture in Katanga and Northern Rhodesia, it therefore looks very much as if the only thing, which can avert a second round of cutbacks by, say, another 5 per cent, would be a sharp revival in the American economy this Spring. Sir Ronald is clearly hopeful that the Kennedy Administration will bring this about as, despite his warning against the dangers of deferring a cutback when the statistical position points to the need for it, his counsel for the moment is still to wait and see.

Meanwhile it is clear that copper producers on both sides of the Atlantic are no longer content to leave the future growth of copper consumption to the "natural" processes of population growth and *per capita* consumption increase. Thus the Copper Products Development Association, an American sponsored producers' association whose activities are mainly directed to the development of new uses for copper and its alloys, now has a membership representing over 90 per cent of the free world's copper production.

At the same time the Copper Promotion Producers' Committee, which is representative of nearly all the African producers and with which it is to be hoped that the American producers will become increasingly closely associated, is stimulating sales promotion work in the main European markets and is planning to extend its activities to emergent countries, particularly those with large populations offering an important consumption potential. As distinct from the American C.P.D.A., the C.P.P.C. is concerned primarily to increase the consumption of copper in its already known uses. These two promotional organizations are thus complementary in purpose and both, it is to be hoped, will ultimately become world-wide in scope. Equally it is to be hoped that the closest liaison will prevail between them.

In last week's issue Mr. McDivitt voiced the view which holds that the copper industry, along with those of the older base metals, is in need of a major mental revolution in its approach to its marketing problems. Be that as it may, it would be unrealistic to expect to see suddenly a complete change in the long standing habit of copper producers to think primarily in terms of producing the metal and getting it to market rather than of ensuring that the market will itself continue to grow. From this standpoint the emergence, however belatedly as some may think, of the C.P.D.A. and the C.P.P.C., can only be welcomed in the hope that their work will be inspired with a sense of high urgency.

What the consumer needs is to be convinced that, where the use of copper is appropriate, it is in fact the best material for his purpose not only in respect of its physical properties and the technical sales service by which it is supported, but equally in terms of availability and price stability. As regards technical considerations, aluminium and nickel as well as the plastics and chemical industries, provide text book examples of what a dynamic marketing policy can achieve. As regards availability and price stability, however, both copper producer and consumer alike have got to do some re-thinking.

Without doubt the biggest single factor in short term market fluctuations in copper since the war has been the size of consumer stockholdings and their liability to sudden release at the first hint of market recession or financial stringency. Some copper producers have latterly been showing an increasing inclination to maintain market stability initially by building up reserve stocks and to cut back production only when these become unmanageable. Such commendable attempts at stabilization will, however, be of no avail so long as the consumer is normally carrying such large stocks that he can flood the market in a sudden de-stocking operation.

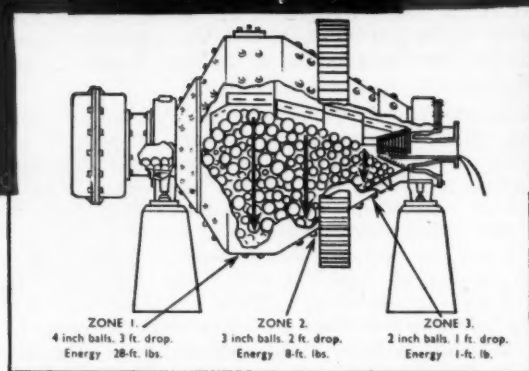
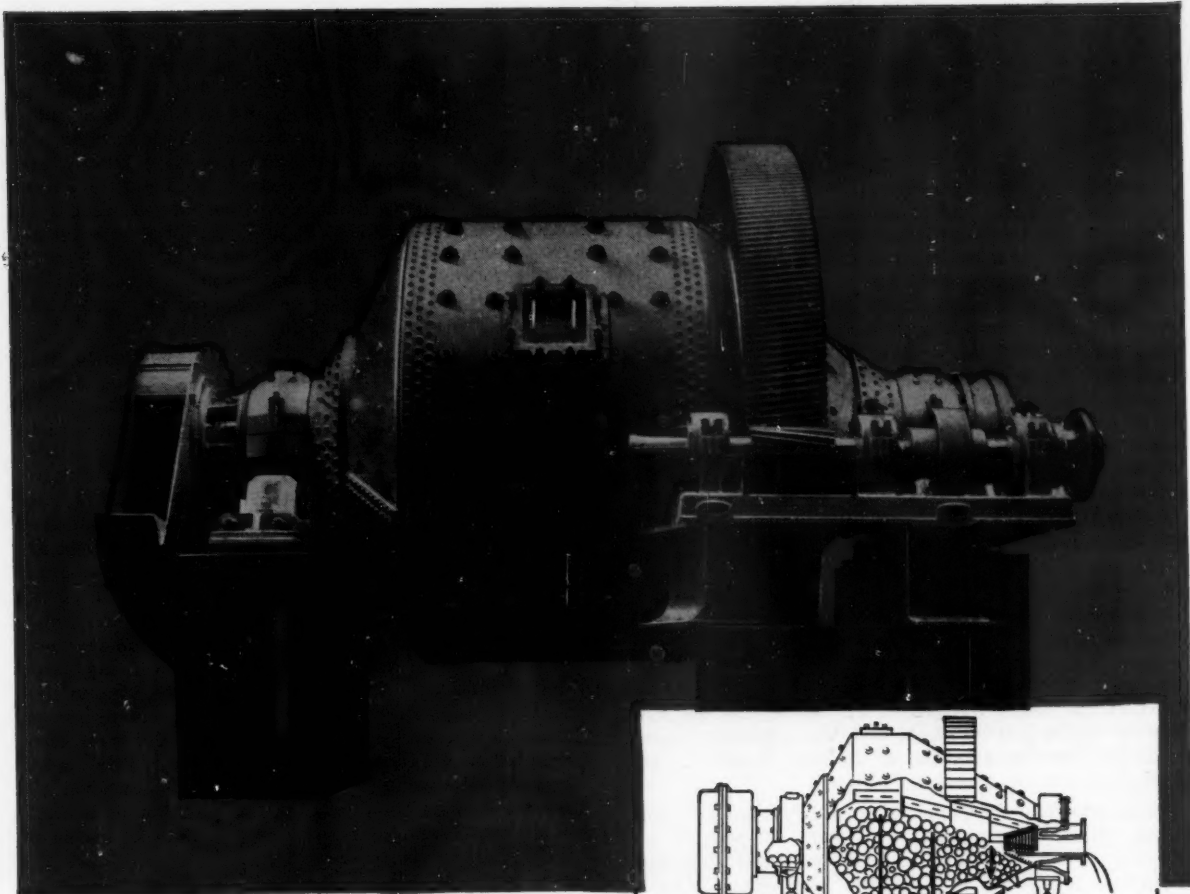
The largest single factor in the higher levels to which consumer stocks have risen on various occasions in recent years is undoubtedly the growth of the practice of long term sales contracts "at the market", which has been a characteristic development of post-war years. For example something near to 90 per cent of the copper sold by Commonwealth producers to British users is disposed of today by direct contract. This is far too high a proportion of purchases on long term commitment for there to be any hope of escaping periods where contract deliveries are in excess of current requirements to the extent that a portion will be thrown back on the market.

If, on the other hand, Commonwealth producers were to agree to limit their long term contracts to say 70 per cent of their U.K. sales, British users would, even in slack times, have to do some hand to mouth buying of spot metal from locally held producer stocks, either by direct negotiation or through the L.M.E., and these would logically be kept to a minimum once the consumer was assured that he could rely on the producer as a stockholder who would not run dry on him and who had learnt the wisdom of stable market prices.

As has been shown with tin control, general agreement among producers and consumers (whether through some formal organization or not is secondary) on such matters as the size of producer stocks, when, where and by how much to apply production cutbacks, and the optimum range within which to stabilize prices, are all essential prerequisites of assured availability at, within limits, predictable prices.

The major obstacle to such international agreement, not only in the case of copper but equally in the case of a number of other commodities, is American anti-trust legislation. It is one thing for the American Government to safeguard its citizens against extortion by would-be monopolists of goods and services distributed within the United States. It is another to pursue the operation of the anti-trust laws to the point of preventing the American producer of commodities, which are subject to the interplay of world supply and demand and which in many cases he will actually be mining outside of the States, from participating in international commodity agreements aimed at stabilizing these markets in the interest not only of the consumer but equally of the producer countries which increasingly are tending to be those which are economically under-developed and politically uncommitted.

Indeed the restraint imposed on American metal producers by the anti-trust laws, coupled with the frequently short-sighted tactics of the Washington mining lobby, have in no small measure been responsible for the sharp fluctuations in the export earnings of the primary producing countries and have thus negated much of the constructive work of the State Department in the field of foreign aid. Some Democrats, such as Mr. Adlai Stevenson, have shown themselves to be keenly aware of this problem but it is early days yet to write with any confidence about the possibility of some easement by the Kennedy Government in the operation of the anti-trust laws in respect of



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the producers of international commodities. We can but hope.

In conclusion this is perhaps an appropriate moment to suggest that while a greater consciousness of marketing problems is undoubtedly a top priority for the copper industry, it by no means follows that it is in the producers' own best interest to accelerate the growth of copper demand to the point where this can only be satisfied at the cost of bringing intrinsically high cost properties into production faster than research into mining methods and extractive techniques can combat rising costs. To do this would be merely to raise the market price against the user in a period when he is becoming increasingly sensitive to such price instability in comparison with materials which characteristically enjoy more stable price structures. To the extent that substitution by such materials serves to stabilize the price of copper by discouraging production increases which can only be achieved at appreciably higher prices, such substitution must be welcomed.

For copper, as for most other sectors of the mining industry, there is an optimum rate of growth, and a heightened marketing consciousness should manifest itself quite as much in assessing how rapidly the copper industry can expand production at stable prices as in considering how best to dispose of this production.

NEW CHAIRMAN FIRES A BROADSIDE

The National Coal Board's new chairman, the Rt. Hon. Alfred Robens, certainly means business in the fight to pull the British coal industry out of the doldrums. Recently he launched the most massive sales campaign in the history of the industry: a campaign designed not only to hold on to existing customers, but to win back markets recently lost to oil. This is going to be a hard battle, but no one can accuse the Board of apathy regarding the outcome. The spending of even several million pounds on a successful sales campaign is more than justified when the cost is set against the £900,000,000 invested within the industry since the mines were nationalized. Indeed, if coalmining in Britain stagnates, it is not only the miners and their dependants who will suffer. British industry will lose much of the £250,000,000 worth of orders a year for machinery and supplies. Many of the factories now blithely converting to oil are conceivably helping themselves on the way to emptier order books.

What is not fully realized by many fuel users is that coal as a fuel is not out of date. More often than not it is the equipment with which it is used that is out of date. Burnt in modern equipment, coal can hold its own with any other fuel, with the possible exception of natural gas, a boggy with which Britain, fortunately, has not as yet to contend. Now we are witnessing a return to the pre-war concept of coal mining: the right quality at the right price. Before the war, many coal owners held the view that getting the coal was relatively easy; selling it was the difficulty. Spearheading the Board's drive, therefore, has been the creation of a greatly expanded sales organization and technical advisory service.

Unfortunately, the apparently insatiable demand for coal during the last twenty years has resulted in the running-down of an effective coal sales organization. With the war and post-war emphasis on "coal at any price", an organization to sell the product appeared to be superfluous, and many experienced coal salesmen moved out of the industry and left a gap, which has only recently become apparent. Good coal salesmen are not, of course, made overnight, and so it will be some considerable time before this new organization can become fully effective.

Now that Britain's pits have been infused with new equipment and techniques, getting the coal should not

prove too difficult. The next few years will show how effective is its disposal. As Mr. Robens has publicly stated, "the Board is determined to fight for a major share in the fuel and power markets for coal, based on a modern, progressive coal industry. This campaign is the first shot in the battle. There are more in our locker. Our ten-word slogan sums up our case remarkably well 'Solid fuel—more heat at less cost—and it's British'".

LONDON-NEW YORK BANKING LINK

Hambros Bank, the London merchant banking house, has entered into formal association with Laidlaw and Company, the only New York firm besides Brown Brothers and Harriman which has a banking franchise as well as a brokerage business.

Although it has taken about 18 months to overcome technical difficulties involved, this new link between the City and Wall Street, which takes effect from May 1, comes at an opportune time when the Kennedy Administration is actively encouraging more co-operation between the U.S. and Europe in trade, finance and economic development.

Hambros has invested \$5,000,000 in Laidlaw through a specially formed American subsidiary called Hambros Delaware Corporation and in return will receive a 65 per cent interest in Laidlaw's banking business. In spite of the majority interest, however, this is not a merger but a limited partnership. By the rules of the New York Stock Exchange, Hambros would not have been permitted to enter into a full partnership with Laidlaw. But it is only the banking side of Laidlaw's business that interests the British bank. Since the war Laidlaw's banking operations have been relatively unimportant, accounting for about 10 per cent of the total business. Under Hambros' direction it is intended to build up deposits and to arrange for European customers to use Laidlaw's acceptance facilities when they require dollar finance and for American customers to use Hambros' acceptance facilities when they, in turn, require sterling finance. The new link extends the American interests of Hambros which in recent years has had a close association with the Empire Trust and this will be continued through Mr. Peter Folliss, an executive vice-president of the Trust who becomes a general partner in Laidlaw.

At a time when American banks are tending to amalgamate it is evident that more scope exists for the close personal banking service and advice in which London merchant banks specialize, especially in regard to international affairs, so that while initially the new association will offer facilities to both American and European industrialists wishing to expand their trade and investment on both sides of the Atlantic, in time operations will no doubt extend much further afield. The link between Hambros and Laidlaw is not unique, Lazards and Schroders operate in both London and New York, Morgan Grenfell are closely allied to Morgans and Warburgs with Kun Loeb.

CHINA'S OUTPUT OF MINING EQUIPMENT RISES

Recent reports from the Far East indicate that China's mining equipment industry is undergoing a rapid expansion. Over the three-month period from December last to February of this year 3,300 electric motors with a total capacity of 340,000 kW. have been produced in Shanghai for the equipment of new mines and the re-equipment of existing ones. This output, which is apparently to be delivered exclusively to mining centres in northern China, is more than the recorded production for the previous eleven months.

Spain's Largest Iron Mine

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DURING the last three years Spain's largest iron ore producer, the Marquesado mine owned by Cia. Andaluza de Minas, S.A. almost doubled its output which climbed from 360,000 tons in 1957 to 504,000 tons in 1959 and approximately 550,000 in 1960. This was about 9 per cent of the total output of Spanish iron ore last year, of 6,000,000 tons compared with 4,655,241 tons the year before.

In 1930 Spain mined some 6,500,000 tons of iron ore. Then came the great world depression, her own long and devastating Civil War and World War II, and not until the 1950's did Spanish iron mines begin to come into their own again.

Located on the edge of a vast alluvial plateau, Cenete de Marquesado, about 1,150 m. above sea level in the southern province of Granada, the mine is 81 km. from the port of Almería and 100 km. from Granada. Ore is shipped via RENFE, the Government Railway system. Roughly two-thirds of the production goes to Almería for export, the remainder to d'Aviles the new steel plant in northern Spain.

Adjoining this mine to the south in Minas Alquife. Here ore is exposed on a low hill, whereas Marquesado ore is below the surface. Under the previous owners, the Bairds Mining Co. Ltd., extensive work was carried out including three shafts below water level and 30 km. of lateral explorations.

In 1931 the new owners initiated a combination of open pit and underground development. Despite long years of frustrating national and international complications, the company has already mined over 4,000,000 tons of ore.

Doubles Output

Reserves are calculated at a minimum of 21,000,000 tons, almost half of them below water level. The ore is covered with a deep deposit of alluvium under which is a thin layer of limestone, and the amount of excavation for bench operations, past and future, has been calculated at 12,000,000 cu. m. of alluvium, 2,840,000 cu. m. of limestone and 10,800,000 tons of iron ore.

Six Phases in Excavating

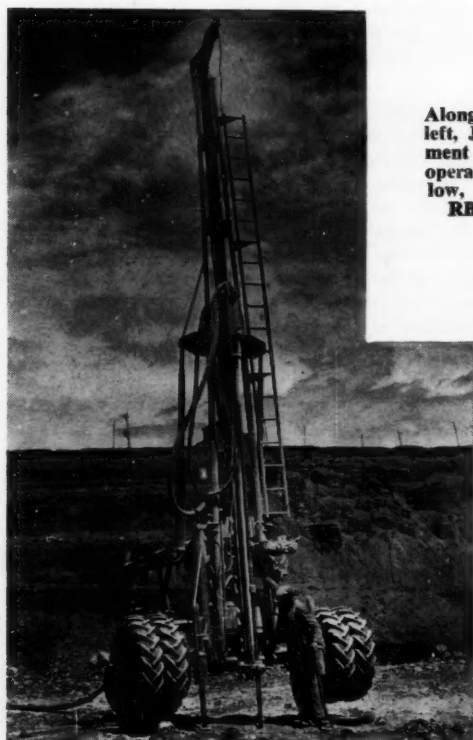
This formidable excavating programme has been divided into six phases.

During operation of the first phase, which began in 1932, some 4,450,000 cu. m. of alluvium and 300,000 cu. m. of limestone were dug, but no ore was produced. In the second phase 1,800,000 tons of iron ore were won which entailed the excavating of 460,000 cu. m. of limestone which had to be removed from the deposits. In this phase too, 3,700,000 cu. m. of alluvium along with 370,000 cu. m. of limestone were dug.

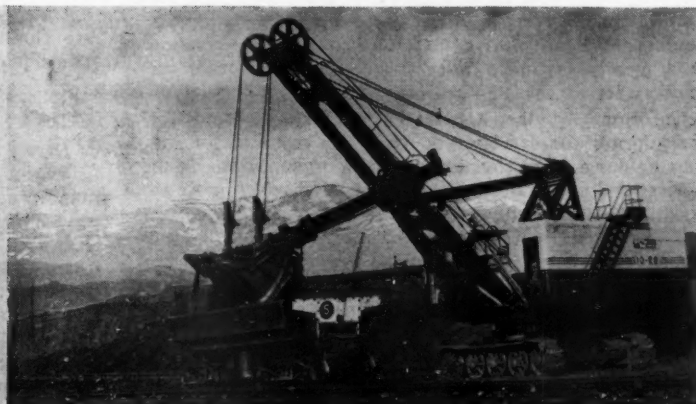
Won in the third phase, being completed last year, were 2,750,000 tons of iron ore and its concomitant 700,000 cu. m. of adjacent limestone. Along with this was uncovered 2,540,000 cu. m. of alluvium and 500,000 cu. m. of limestone to make the second enlargement. This second enlargement is being exploited in the fourth phase to produce 2,750,000 tons of iron which necessitates the removal of 700,000 cu. m. of limestone. At the same time to make the third enlargement 3,850,000 cu. m. of alluvium will be uncovered along with 10,000 cu. m. of limestone.

From the third enlargement the fifth phase aims at the production of 1,900,000 tons of ore along with the excavation of 150,000 cu. m. of limestone. Furthermore, 5,570,000 cu. m. of limestone will be dug to make the fourth enlargement. Exploitation of this enlargement in the fifth phase will produce 1,600,000 tons of iron ore and 50,000 cu. m. of limestone.

So far the entire excavation programme has been accomplished by seven shovels of the Bucyrus family. Two



Alongside, at left, Joy equipment in drilling operations. Below, a 110 RB shovel





Cat D9 dozer cleans up for ore excavation

additional shovels, Ruston-Bucyrus 10 RB $\frac{1}{2}$ of a yard, do auxiliary work making a total of nine belonging to one clan. Two of the six shovels in the pit include two Bucyrus-Erie 75B electrics. Purchased in 1932 and in 1934 respectively they have been responsible for the excavation of over 10,000,000 tons of material and are still giving good service. The other shovels are Bucyrus-Erie design manufactured in England under the name of Ruston-Bucyrus. There are seven of these: two Ruston-Bucyrus' 54 RBs, two and a half yards Ward-Leonard electric; two Ruston-Bucyrus 38 RBs electric one and a half yards; one new 110 RB four and a half yards and the two small RBs. The largest shovels handle the overburden, the 38 RB's, the mineral ore.

Above to the left of the pit entrance, a new 110 RB Ward-Leonard electric, the largest in Spain, is used on alluvium. This is to make the fourth pit enlargement, which may take seven to eight years to complete. So abrasive is the material that shovels digging alluvium have their teeth changed every week.

In the pit far to the right, Euclids dump mineral ore into a hopper which lets on to an enclosed 9 m. long conveyor to serve 2 cu. yd. skips. These are pulled 90 m. to the surface over a 45 deg. concrete apron. This skip system also handles the pit alluvium. It has a capacity of 180 tons an hour, was designed and built in the local shops.

Reaching the surface the skips dump into loading bins, which empty into 25 ton Woodford cars. This English Woodford system operated by remote control was installed in 1931. The cars run on tracks, maximum grade 6 per cent with power via electric motor to a third rail.

The cars convey the ore to the screening and sizing plant which has an 1,800 t.p.h. capacity. The alluvium which is brought up via the skips goes to waste dumps which probably contain 12,000,000 cu. m. of alluvium and 2,000,000 cu. m. of limestone.

For blasting limestone and iron ore a Joy Challenger 500 T blast drill coupled with a mobile Joy 600 compressor is used. Power is given by Trinolite No. 1 (80 per cent ammonium nitrate and 20 per cent nitroglycerine) in the proportion of 220 grm. per cu. m. In eight hours 10,000 m. of material can be blasted. Two medium weight Joy wagon drills and jackhammers prepare for secondary blasting.

The clearing away of the final layer of limestone and/or alluvium from the ore can sometimes be a ticklish job and frequently must be done by hand. However a continental tractor shovel is also used and at times a new D9 Cat dozer or D7 Cat dozer. The two Cats also clean up around the shovels. Other machinery includes the sixteen Euclids.

Of the 850 men employed by the company 212 work in the underground mine which produces about a quarter of the ore. Sublevel caving is used in hard core sections, cut and fill in the medium soft. The mineral is broken down with push drills. Hudson Hunslet locomotives take off from loading chutes to shaft stations; Woodford cars on the surface deliver it to the screening and sizing plants.

Underground Problems

The main difficulty encountered underground is water. At the water level altitude, 1,040 m. is an underground lake which makes operations very costly. After extensive study engineers agreed on a 3 km. tunnel which will reduce the pump head from 140 m. to 46 m. Construction will begin early in 1961.

A second problem is electric power. The company has developed three sources, but none is entirely satisfactory. About 11 km. from the mine are two hydro-electric plants with a 100 m. and 250 m. head, respectively. For five months of the year when the snows melt rapidly these falls furnish from 400 kW. to 600 kW. During the remaining months the figure drops from 150 to 350 kW. Both plants use Pelton turbines and the Thury system. There is also a three unit Diesel power plant with a maximum output of 100 kW. The third supply, from a public utility El Chorro, is not very dependable.

The mine, a day's travel by train or car from Madrid, is located in a semi desert region, hence it must be self-sufficient for services. And partly because of belated delivery of spare parts from overseas suppliers a meticulous maintenance and repair programme has been put in operation.

Because of the isolation of the mine, the Cia. Andaluza de Minas has provided houses for engineers, foremen, technical men and all employees not recruited locally. Other amenities include a modern hospital and school.


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Ion Exchange for Gold Recovery

AN account of an investigation into ion exchange for gold recovery has recently been presented to the Institution of Mining and Metallurgy. In a paper of great interest and abounding in data, J. Davidson, F. O. Read, F. D. L. Noakes and F. V. Arden described the investigations carried out by Connit Ltd., a joint company formed by The Permutit Co. and Consolidated Gold Fields of South Africa to undertake the work. As a result an adsorption-selective elution was developed incorporating a novel process termed dynamic electrolution and preliminary work using a resin-in-pulp process indicates that such a process may have economic possibilities when used in conjunction with dynamic electrolution technique. It would appear, however, that the processes apply only to gold ores which do not produce foul pregnant solutions.

Since ion exchange is generally most useful for treating dilute solutions containing metal ions to the order of 10 parts per million or less, it well might be applied to extracting gold from cyanide liquors. In 1945 it was demonstrated that anion exchange resins could be used on a solution of gold chloride. Later work was undertaken with cyanide solutions but it was not until Wells developed suitable resins at the National Chemical laboratories that any success was achieved. By using a series of selective eluting agents it was found possible to remove the various metals successively. Since then a series of dimethylamine anion resins have been prepared with a marked selectivity for gold and silver in cyanide solution so that elution is simpler and the resins can be regenerated for further use.

The Ion Exchange Process

There are obviously a number of ways in which ion exchange can be applied in gold or gold-uranium ores. One can filter and clarify the pregnant solution and then make use of the enriched eluate from exchange columns to yield refined gold by electrolysis or one might employ a resin in pulp technique and so save the filtration stage. If uranium were to be recovered at the same time one could employ a similar technique after uranium leaching of the gold barren pulp, and reverse the process to extract the uranium first.

The resin-in-pulp approach is the most attractive since not only would the expensive filtration be eliminated but the losses so incurred might also be reduced. Furthermore, in gold-uranium ores, removing the uranium first by acid leaching will also remove base metals from the ore and would give a cleaner gold solution, together with the possibility of a reduction in cyanide consumption. At the same time, troubles could be encountered owing to the interference of complex cyanides in the uranium ion exchange process.

Of course, with the exchange process used in a clarified solution to compete with current practice, it must be cheap although some benefit might be obtained in the production of refined gold. On the other hand, the resin-in-pulp is more attractive for a number of reasons.

In the research programme described, both these approaches were examined and extensive tests were undertaken on 20 resins and a De Acidite H resin containing 24 per cent of strong base groups was chosen as having the best all round characteristics of selectivity and high capacity for gold, although it was not sufficiently selective to treat a "foul" solution and possessed too low a capacity to compete with existing zinc precipitation on the Rand where the costs are exceptionally low.

Other resins with lower percentages of strong base groups were also tested as well as the effect of variables such as the contact time, lowering of the pH of the pregnant solution, intermittent acid washing, the use of resin in various salt forms the effect of anions other than gold, increasing the strong base content of the resin and increasing the concentration of competing ions.

In general, it was found that there was an optimum contact time of 2-3 min. when a balance was struck between the asset of a higher gold loading and the disadvantage of increased slippage and self-elution. With lower pH values, the gold adsorption capacity was increased but the selectivity of the resin for gold was decreased.

Conclusions as to the effect of cations was that zinc at the 14 p.p.m. level resulted in a markedly reduced resin adsorption capacity for gold, while the presence of free cyanide and protective alkalinity at the levels of 0.02 per cent NaCN and 0.02 per cent CaO also caused a marked reduction in gold adsorption and appeared to be largely a pH effect. When the protective alkalinity or the free cyanide was high, the total adsorption capacity of the resin was of the same order as that of the strong base resins.

As far as the strong base content of the resin was concerned, the gold adsorption capacity of De-Acidite H resin increased with increasing strong base content, but the selectivity towards gold tended to decrease although the effect was quite small when compared to the increased gold loading obtained.

Competing ions reduced the gold adsorption capacity of the resins as well as selectivity, the effects becoming more marked as the strong-base contents increased. Iron had relatively little effect, copper an increased effect and nickel the most depressing effect on both capacity and selectivity.

In the initial approach a non-selective alkaline the cyanate elution system was envisaged and various factors were examined including the recovery of gold from the eluates. Mercury was found to recover the gold but the rate of removal was prohibitively low. Activated charcoal was satisfactory but was rejected on a cost basis. This led to the recovery by electrolysis of the thio-cyanate eluates using a carbon anode and a chemically pure assay lead foil cathode. The eluate was mechanically agitated and an e.m.f. of 1.5V. applied, the cathode current density was about 2 mA./sq. in.

Although it was possible to remove the gold from thio-cyanate eluates, regeneration of thio-cyanate was unsuccessful and attention was directed towards a selective elution system rather than a selective precipitation system.

Feasible Processes

Eventually a process in which loaded ion exchange resin was agitated in an "electroluent" contained in a cell through which a current was passing. This effected simultaneous elution and recovery of the gold as metal.

The gold was recovered on the lead cathode in approximately 24 hrs. An advantage of this process is the very small volume of electroluent required not only reducing the amount to be handled but also the capital cost, while power cost is only some 0.02d. per oz. of gold recovered. Attention was directed to non-selective dynamic elution and ammonium thio-cyanate was proved effective and other eluates such as ammonium nitrate showed promise.

A selective elution system has also been proved basically feasible: the loaded resin was eluted first with sodium

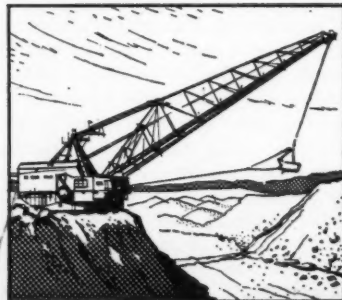


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cyanide to remove copper and then with sulphuric acid to remove nickel. Although elution with thio-cyanate of the resin in the sulphate form was unsuccessful it was overcome by using an alkaline solution. Further elution with sulphuric acid also removed thio-cyanate remaining on the resin.

Perhaps the most interesting work is the development of a resin-in-pulp apparatus and a suitable process for the recovery of gold. After several tests, the resin loss was estimated as approximately 5 per cent but this may be high due to handling in the tests: loading of resin appeared to be lower in the resin-in-pulp process, but the test work has demonstrated the feasibility of the technique.

Finally, the selective elution process was worked out for column exchange on the basis of loading for 5-7 days and then eluted first with NaCN to remove copper, with H_2SO_4 to remove nickel, followed by dynamic electrolution for the recovery of gold and elution with H_2SO_4 to recover this cyanate. The tentative costs, however, indicate that a total cost of 8.79d. per ton of solution treated is likely, which does not compete with 3.5 to 4.0d. per ton of pregnant solution at present incurred in the Witwatersrand.

On the other hand, non-selective dynamic electrolution using an eluate other than thio-cyanate might reduce the cost. With the resin-in-pulp process there is a saving of filtration costs which amount to 7.58d. per ton so that on

the estimated cost of 3.74d. per zinc precipitation and 8.26d. for resin-in-pulp operation (excluding reagent cost) there is 3.06d. available for reagent cost to break even, and it seems possible that a resin-in-pulp process might be slightly cheaper by just under one penny per ton. At least the resin-in-pulp process appears to be reasonably economically attractive. It is clear, however, that gold can be collected on ion exchange resin from cyanide solution, provided that the ratio of impurities to gold is not too high but the operating cost of the chemical process has been estimated as being somewhat greater than the conventional process and since it appears to be more sensitive to impurities than the Merrill-Crowe process, the most favourable application would be found in the treatment of solutions or in particular, of pulps carrying high gold values and relatively low concentrations of competing ions.

Since the filtration step might be eliminated, the resin-in-pulp process may be an attractive and economic proposition—particularly for ores which are difficult to filter—provided there are few competing ions.

With the dynamic electrolution process in a selective elution system, it should be possible to produce gold in a high state of purity, but none of the resins tested was sufficiently selective for gold to obviate a selective elution or selective precipitation system. Further discoveries, however, having a higher capacity and selectivity for gold could have a material effect on the economics of the process.

Some Mining Results in 1960

THE total value of minerals produced in Kenya during 1960 is not yet known, but present indications are that it will exceed £5,000,000 for the second year in succession. It is likely to be roughly £200,000 less than the all-time record of £5,319,355 set up in 1959.

Small increases were recorded in the value of asbestos, graphite, kyanite, limestone products (other than for cement), meerschaut, raw crushed soda, salt and vermiculite produced during the year, but decreases were recorded in the value of copper, gold, silver, diatomite, mullite, pumice, magnesite, mica and kaolin.

Re-sampling of niobium-bearing prospect at Mrima hill continued and was still in progress at the close of the year.

During the course of the year the Geological Survey mapped geologically some 6,279 sq. miles, bringing the total area so covered to approximately 119,355 sq. miles, or more than 50 per cent of the total area of the Colony.

Belgium

Over last year Belgium produced about 211,774 tonnes of copper, compared with only 185,690 tonnes in 1959. Over the same period output of zinc rose from 224,302 tonnes to 247,563 tonnes, that of lead from 88,441 tonnes to 92,705 tonnes, tin from 6,714 tonnes to 8,652 tonnes and aluminium from 2,730 tonnes to 2,774 tonnes. Output of "other non-ferrous metals" including antimony, cadmium, nickel, cobalt and other minerals, fell over the year, however, from a combined total of 4,850 tonnes in 1959 to 4,593 tonnes in 1960.

Over the range of rare metals, exports were generally higher. Belgian cadmium exports last year totalled 718 tonnes worth 105,720,000 Belgian francs, against 686 tonnes worth 84,330,000 francs. The chief customers for Belgian cadmium last year were West Germany, France and the United Kingdom, the latter taking 84,800 tonnes. Belgium's germanium exports more than doubled to

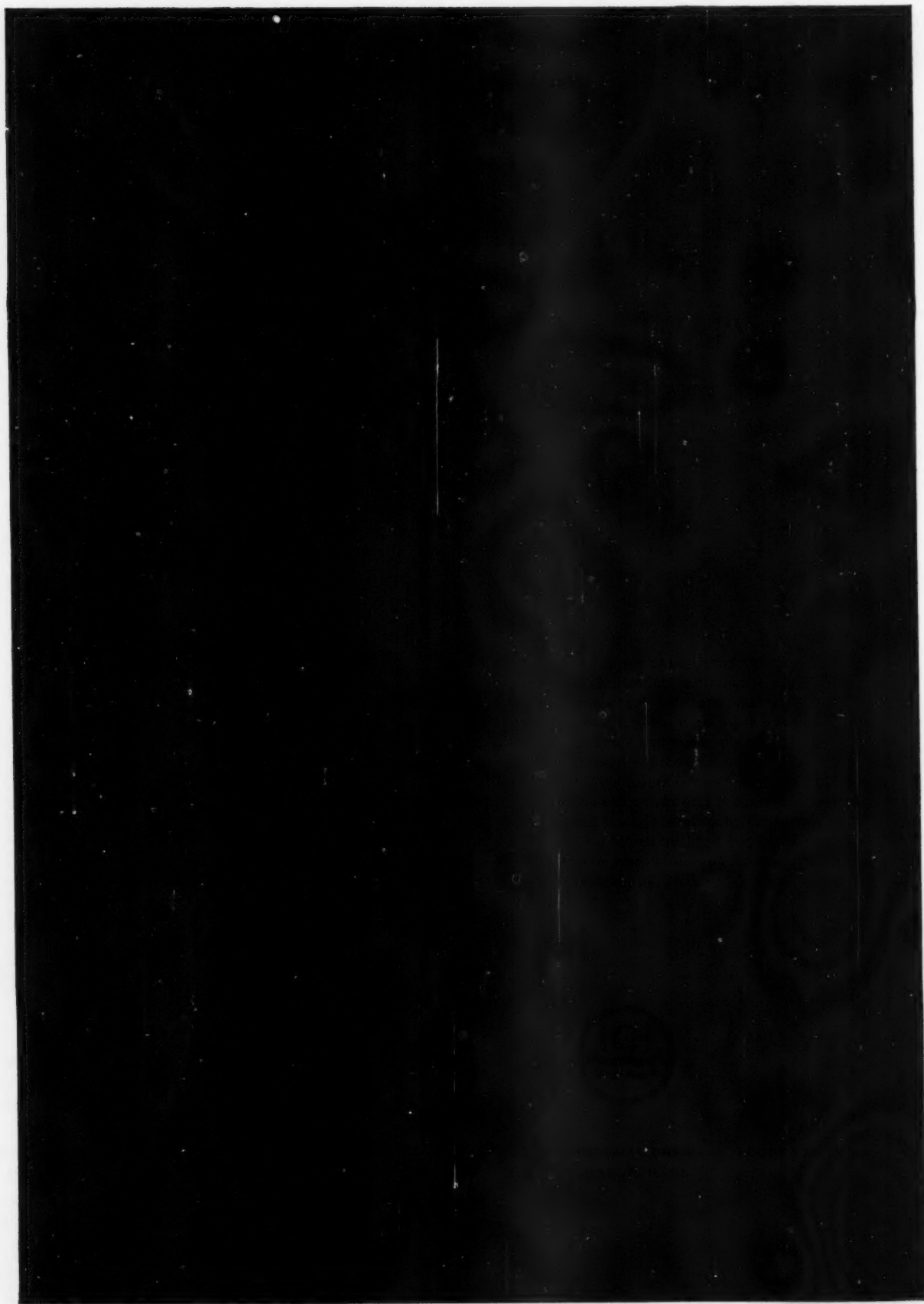
14,600 (6,200) tonnes worth 207,270,000 francs, (108,530,000). Here again the main customers were West Germany, the United Kingdom (with 3,800 tonnes) and France. Belgian exports of uranium and thorium in processed form, however, were down last year compared with 1959 because no exports at all were recorded for the latter part of the year. In all, 2,100 (2,600) tonnes were exported at a combined value of 3,990,000 francs. (5,380,000).

Norway

Norway increased its production and exports of most metallic minerals and finished metals during 1960. Aluminium output rose over the year from 148,400 tonnes to 165,400 tonnes and exports from 136,700 tonnes to 143,500 tonnes. Nickel production was up from 26,000 tonnes to 30,400 tonnes, while exports increased from 26,400 tonnes to 28,200 tonnes. Ferro-silicon production, which in 1959 totalled 126,900 tonnes, was brought up to 167,100 tonnes last year, and exports rose from 122,900 tonnes to 157,500 tonnes. Production of other ferro-alloys increased from 157,800 tonnes to 172,600 tonnes and exports rose from 162,500 tonnes to 167,600 tonnes. Copper production rose from 19,200 tonnes to 21,500 tonnes in spite of a disappointing output of copper ore and concentrates at 28,900 tonnes. Copper exports, however, fell by almost 50 per cent over the year: from 40,500 tonnes to 20,900 tonnes, while those of copper ore and concentrates increased from 10,500 tonnes to 14,800 tonnes. Both production and exports of Norwegian zinc decreased over last year: production fell 2,200 tonnes to 44,600 tonnes while exports fell 4,300 tonnes to 33,200 tonnes, in spite of a slight increase in output of lead and zinc concentrates.

Turning to ferrous metals, output of iron ore rose over the year from 1,773,000 tonnes to 1,812,400 tonnes and exports from 939,700 tonnes to 1,192,000 tonnes.

Coal production rose sharply, from 251,700 tonnes in 1959 to 402,200 tonnes last year.



The European Community and Mineral Production by its Overseas Partners

WHEN, in 1953/54, the European Coal and Steel Community common markets for coal, iron ore, scrap, steel and special steels were set up, to be followed, in 1958, by the implementation of the Rome Treaties setting up a general European Common Market, special provisions were made for the association of the overseas countries with which the members of the Common Market already had special links. The intended aim is to promote economic and social development and to establish economic relations between the overseas countries and the Community as a whole.

Association with the Common Market permits overseas partners to levy customs duties to meet the needs of their developing industries and to levy fiscal duties to increase their national budgets, the only stipulation being that these duties must apply to imports from all the six European Community countries without discrimination.

Most of the overseas territories are located on the African continent, the exceptions being Netherlands New Guinea, St. Pierre and Miquelon, New Caledonia and dependencies, the French settlements in Oceania and the Southern and Antarctic Territories. Their total area is 4,733,200 sq. miles and their total population 53,000,000.

Over a 12-15 year transition period, the Community countries will gradually abolish all tariffs and quota restrictions on imports from the overseas countries and territories, which, in turn, will extend to the whole Community the preferential terms they now grant to any of its members.

At present the associated countries are chiefly exporters of agricultural and industrial raw materials, which make up 90 per cent of the total figure. Since World War II, there has been a rapid rise in production and exports.

The Main Mineral Products

During 1953/55, the time at which the European Coal and Steel Community was being established, the main mineral products of the associated countries and territories were as follows:—

	Production (average 1953/55)	Percentage of World Production
Diamonds*	12,900,000 carats	64.2
Phosphates	487,000 tonnes	1.9
Copper (concentrates and metal)	219,000	3.3
Manganese (ore and concentrates)	355,000	3.8
Chrome (ore and concentrates)	84,000	2.4

*including industrial diamonds.

Since 1953, iron ore exports from the associated overseas countries increased from 350,000 tonnes to 833,000 tonnes in 1956, falling away to 644,000 tonnes in 1958. During these years, the European Community's consumption of iron ore has increased from 25,000,000 tonnes in 1953 to 37,000,000 tonnes in 1958 and it has been estimated that, with greater purchasing power and a growing population, the annual consumption of iron ore in the European Community will, by 1970, have risen by at least a further

10,000,000 tonnes. Steel production in 1959 was 63,000,000 tonnes and the Community was the world's second largest producer of steel after the U.S.

Article 55 of the Coal and Steel Community Treaty authorizes its High Authority to encourage technical and economic research or investigation into the production and consumption of coal and steel. In this connection, the High Authority is co-operating with the French Bureau of Mines on a five-year programme of prospecting for iron and manganese ore in the associated overseas countries. The High Authority's financial aid for this programme will amount to \$5,000,000, of which \$1,260,000 has already been earmarked for work in Gaboon, Ivory Coast and Cameroon.

About 95 per cent of the copper and 97 per cent of the tin produced in the associated overseas countries, it is claimed, is sold in the European Community.

Output of Individual Countries

Of all the associated overseas countries, the Congo yields the largest supply of minerals. What the future of this region will be is anybody's guess, but, in 1958, the Belgian Congo and Ruanda-Urundi produced 669,329 ct. of Kasai diamonds (30 per cent gemstones) and 16,004,145 ct. (14,324,053 ct. in 1959) of Lubilash diamonds (98 per cent industrial); 11,775 kg. of gold (10,666.5 kg. in 1959); 237,562 tonnes of copper (280,403 tonnes in 1959); 280,000 tonnes of manganese, as well as cobalt, zinc, germanium, cadmium, tin, tungsten, wolfram, uranium and bauxite.

New Caledonia produces nickel, cobalt, chrome and iron ore. The nickel ore is smelted locally and the mattes sent to France. Production in 1960 is expected to be about 1,800,000 tonnes of ore, compared with 1,378,000 tonnes in 1959, 591,000 tonnes in 1958 (recession year) and 1,800,000 tonnes in 1957.

Other mineral products obtained from the associated overseas countries include: Cameroon cassiterite and gold; Senegal, aluminium phosphate, ilmenite; Ivory Coast, diamonds; Niger, cassiterite; Upper Volta, gold; Gaboon, gold, crude oil; Central African Republic, diamonds, gold; Madagascar, graphite, mica, beryl, quartz, garnet, phosphate; Netherlands New Guinea, gold; French Polynesia, phosphate of lime. Other overseas countries include also Chad, Dahomey, Mauritania, Sudan, Somali, Comoro, Togoland, but in these countries mineral production is negligible.

In addition to the aid given by the High Authority of ECSC, the Community has set up a special \$581,250,000 general Development Fund to help develop these countries and territories over the first five years. To this fund, Germany and France each contribute \$200,000,000, Belgium and Holland \$70,000,000 each, Italy \$40,000,000 and Luxembourg \$1,250,000. The fund is being allocated to the associated countries and territories as follows:—to those associated with France \$511,250,000, the Netherlands \$35,000,000, Belgium \$30,000,000 and Italy \$5,000,000.

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The Mineral Wealth of Wales

THOUGH it is as a coal producer that Wales ranks as an important mining country, its mineral output also includes iron ore as well as slates, sandstones and limestones, clays, and other building materials of high quality. Lead and zinc have been mined in Wales for hundreds of years but are no longer in production, while other minerals to be exploited in past years included copper, gold and manganese ore.

Two chapters of Mr. Thomas's book are devoted to coal, dealing respectively with the South Wales and North Wales coalfields. The former contains sufficient coal for more than 200 years deep mining and includes the largest reserves of high-grade anthracite, dry steam and medium-volatile special coking coals of any one coalfield in the British Isles. Physical mining conditions are difficult.

North Wales coals in 1945, showed reserves of workable coal in seams over 2 ft. thick and at depths less than 3,600 ft. was calculated at 810,000,000 tons. On present knowledge it is expected that each of the six major collieries in this field will have a life of at least 20 years. No new sinkings are envisaged at the moment. For any long-term mining of the deeper reserves new shafts sunk to depths of at least 1,200 yds. will be necessary.

Wales is not so richly endowed with resources of iron ore of high metallic content as with high-grade coal, limestone or igneous rocks. In the author's opinion the genesis of the hematitic orebodies of the Vale of Glamorgan area presents a field for research which might have important economic consequences. For more than 20 years Llanharry in the Vale of Glamorgan has been the only active iron ore mine. The ore is in the top grade of British samples and when hand-picked averages 45-55 per cent iron. A reconstruction and development scheme, now well under way, is likely to involve capital expenditure in the order of £250,000. The two active shafts, now 320 ft. deep, are expected to be deepened in stages to the 520 and 720 ft. levels, and possibly at a later date to 1,000 ft. The area to the east of the mine, last worked in 1924, will possibly be re-entered. In 1957 the proved ore reserves were calculated as being sufficient for 15-20 year's working at the existing output rate.

No Lead or Zinc at Present Prices

Not the least interesting chapter is that dealing with lead and zinc. In northern Flintshire lead mining dates back at least to Roman days. Both here and further south in central Flintshire and east Denbighshire the larger mines have since had a chequered history. Many of the earlier and smaller mines were abandoned because of drainage difficulties. The reasons for the rapid decline in lead and zinc mining in the past 70-80 years are briefly set out. In the last quarter of the nineteenth century the discovery of the great and easily-worked deposits in the U.S. and elsewhere led to a severe drop in metal prices. As a result, the Welsh mines along with other mines in Britain for the most part failed to retain their markets. Cessation of work at many mines and the restriction of operations at others meant that exploratory development was reduced or entirely stopped. Moreover, during and after World War I improvements in flotation processes brought into economic range an immense tonnage from complex ores all over the world.

While there can be little doubt regarding the existence of substantial resources in some of the former mining areas, the problem of discovering them without excessive

The distribution, extent, nature and economics of the known mineral occurrences in Wales are surveyed by Trevor M. Thomas in a book entitled "The Mineral Wealth of Wales and its Exploitation" (Oliver and Boyd, Tweeddale Court, Edinburgh 1, pp. 248, price 30s.). The author has specialized in the study of mineral resources in relation to land use and planning

expenditure is likely to be great. As yet the various geophysical methods of prospecting do not offer any positive and direct method of locating the normal Welsh lead- or zinc-bearing lodes. The author also considers it very unlikely that additional metalliferous mineral areas, entirely divorced from the old mining fields, remain to be discovered.

Welsh Gold

Gold has been mined from three main areas in Wales: the Dolgellau gold belt of Merioneth, the Pumpsaint area of northern Carmarthenshire, and the central section of the Clwydian Hills in western Flintshire. The auriferous lodes of Merioneth appear to have first received serious attention about 1943. In all, the Merioneth mines produced 128,161 oz. from 283,537 tons of ore between 1844 and 1938. In the past 20 years there has been no recorded output, although some minor activity has occasionally been reported. No serious attempt at revival of gold mining is likely to be forthcoming.

The Ogofau gold mine, near Pumpsaint, shows undisputed evidence of relatively large-scale mining during the Roman era. In more recent years mining has been successively carried on by a number of companies, the last venture being abandoned in 1939. A zone of intense crumpling at least 400 ft thick can be traced for many thousands of feet, being well marked by shallow old workings. The upper half of this zone contains two fairly persistent auriferous bands averaging about 4 dwt. per ton. The borehole results obtained before 1939 suggest that the lower 200 ft. contains at least two bands of ore. The favourable probability for persistence in depth, for extension along the strike, and for the presence of these ore bands on the several adjoining folds, not explored, suggests that this area has attractive possibilities as a low-grade ore prospect.

Copper and Manganese

Copper ores have been worked in various parts of Wales, but with the exception of the Parys and Mona mines in Anglesey, all the mining undertakings were small, or relatively small concerns.

Practically all the manganese ore produced in Great Britain in the twentieth century has been raised in Wales, but there has been no production since 1945. Benallt mine in the Aberdaron district, the last undertaking to function in Wales, is of scientific interest owing to the discovery of a number of completely new manganese minerals. In west Merioneth the available resources are large, but the low grade of the ore as compared with foreign ores has prohibited any renewal of mining in the past three decades.



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Machinery and Equipment

Diamonds for Project "Mohole"

About 3,000 carats of diamond drill material arrived in Washington recently from Industrial Distributors (1946) Ltd., a subsidiary of De Beers Consolidated Mines, for use in project "Mohole". Many American firms are supporting the project but Industrial Distributors is the only company located outside the U.S. that has, so far, contributed material for this important research project.

American scientists are now testing the equipment to be used in drilling through the earth's crust to the underlying rock to determine the composition and physical properties of these two parts of the earth's sphere. Drilling will take place below the ocean at a depth of several miles, where the earth's crust is considerably thinner than under land masses. The extreme difficulty, expense and waste of time involved in withdrawing the drill bits for replacement from such depths are largely avoided by using well-designed diamond crowns. Industrial Distributors have provided large solid block-like crystals free from fragile edges or points that could break and pull out from the drilling bit. These stones, similar to those used in drill crowns for oil well drilling, will withstand the enormous stresses to be encountered.

Some 2,500 diamonds are required for a coring crown of the type to be used in the "Mohole".

SURVEYING DEEP BOREHOLES

An electronic instrument for surveying deep boreholes has been designed and developed in South Africa by Hard Metals Ltd., one of the group of companies associated with Anglo American Corporation of South Africa. It has been described in *Mining and Chemical Engineering Review*.

When a borehole is sunk, variations in the nature of the ground usually cause the hole to deviate from the vertical. It is necessary at intervals to measure the angle of deviation and its direction in the horizontal plane so that corrective measures may be taken. The necessary information is quickly obtained by this electronic instrument, described in *Optima*, Vol. 10, No. 1, a quarterly review published by the Anglo American Corporation of South Africa.

Any number of readings may be taken at various depths, for the response of the instrument to changes of angle and direction is rapid. The information is transmitted through a cable to the surface, where it is read off calibrated dials.

Our contemporary describes the instrument as containing a stable radio frequency oscillator, connected through the lowering cable to a console on the surface of the ground. The console contains another oscillator working at the same frequency. The oscillator in the survey instrument is tuned by a variable condenser. Attached to the moving plates of the condenser is a pendulum, which hangs vertically under correct operating conditions.

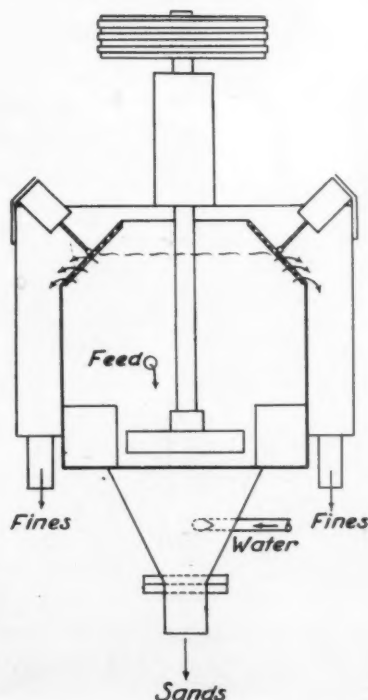
When the instrument is lowered into a borehole, the casing of the instrument will be tilted to the angle at which the borehole deviates from the vertical



A total of 2,500 diamonds face this drilling crown for the Mohole Project. The 9 in. crown will cut a 1½ in. core

plane. When the pendulum is vertical, the moving plates of the condenser are displaced from the fixed plates by an angle equal to the angle of deviation of the borehole. The displacement of the condenser plates changes the frequency

The principal features of the screening cell developed by Hukki



of the oscillator. The difference between that frequency and the frequency of the reference oscillator on the surface is measured, and presented on a dial calibrated in degrees, representing the angle to which the survey instrument has been tilted by deviation to borehole. It is, however, necessary to know in which direction, in the horizontal plane, the borehole deviates, so that a correction can be applied. For this purpose, the pendulum, with its associated equipment, is made to revolve inside the instrument casing.

In one series of tests, six readings were taken at each of eleven different depths in a borehole down to 1,760 ft. Where variations in the readings occurred, they were generally less than 0.1 deg. in vertical inclination and less than 5 deg. in the horizontal plane.

NOVEL METHOD OF WET SCREENING

A new apparatus termed the screening cell has been developed by R. T. Hukki at the State Institute for Technical Research, Helsinki, and has been described in a paper entitled "Precision Sizing of Finely Divided Solids" and appearing in *Aufbereitungs Technik*.

As can be seen from the accompanying diagram, the cell consists of a rectangular tank provided with a mechanical mixing device and surmounted by from 1 to 4 inclined vibrating screens. Pulp in the cell is directed over the underside of the screening surface by the action of the impeller and suitable vanes, and the undersize collected by launders. Oversize is retained in the cell and is discharged through a valve situated in the conical base of the tank into which water is introduced tangentially.

Preliminary tests indicate that the capacity of this new device in the size range from 0.1 to 1.0 mm. is 10 to 50 times as great as that of any conventional screen, whether operated wet or dry. At the same time, the sharpness of separation is said to be far superior to anything obtained by means of conventional classification and equals that experienced in conventional screening.

SQUIRREL CAGE MOTORS

The Engineering Group of The General Electric Co. Ltd., has recently revised Technical Description No. 277 which deals with high torque, high slip and high reactance squirrel cage motors.

High torque motors are substantially the same as standard squirrel cage motors with the exception that the rotor has two separate squirrel cage windings. One of these windings has a high resistance and low reactance while the other has a low resistance and high reactance. The combination of the output torques of these two windings produces a comparatively high torque from standstill to full speed. By adjustment of the values of the resistances of the two windings, different speed-torque characteristics can be obtained giving motors

MARION REPORTS . . . on the 111-M in Zinc

In remote northwestern Quebec, where winter temperatures sometimes drop to 50 degrees below zero and where heavy rains impede work in the spring and fall—a team of electrically-powered 4-yard Marion 111-M shovels steadily digs away in a zinc mine. One machine loads an average of 6,000 tons of shot waste rock per 24-hour work day; the other loads an average of 4,800 tons of zinc ore during the same period.

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eminently suitable for, say, lift operation.

High slip motors are employed where the load varies very rapidly, sometimes to the extent of consisting of a series of sharp peaks with periods of light load, examples being shears, presses and hammers. Usually such machines have a flywheel embodied in their construction and to reduce the power drawn from the supply it is necessary to arrange for the drive motor to run with something like 10 per cent slip at full load. This necessitates a special design of rotor winding capable of dissipating the increased power generated in it. G.E.C. has available a range of high slip motors for the types of drives mentioned above with outputs as high as 200 h.p.

High reactance motors are available for direct-on-line starting. This type of motor is especially suitable for drives in which inertia is high, such as a fan having a heavy impeller, and for pumps starting up on load. The speed-torque curves of such a motor follow the same pattern as the required driving torque with sufficient excess to allow for smooth acceleration.

MARY KATHLEEN URANIUM

The Mary Kathleen uranium mine, in North Queensland, has ore reserves of 4,507,030 tons with a grade of 3.29 lb. uranium oxide per ton, and 1,235,700 tons of possible ore with a grade of 4.17 lb. Reserves, at the present rate of production, are equivalent to a life of nine years. Interesting operating features are the use of cetyl alcohol on the water surface of the dam, which has reduced the rate of evaporation loss by 20 or 25 per cent.

Experiments on electronic sorting have been in progress for some while, but it is Mary Kathleen that has the first successfully operating plant. It was installed in May, 1960, and after a period of adjustment it is now rejecting over 22 per cent of the material that was previously passing, unwanted, through the recovery plant. The large new crushing plant has also been commissioned and thus Mary Kathleen is now in a position to crush and up-grade, by sorting its stockpile of marginal ore. The effect upon throughput has enabled the company to produce 140,000 lb. more uranium oxide than would have been possible without it. Use of ammonium nitrate explosive has reduced mining costs. Plans are in hand to examine the possibilities of electronic sorting in wider fields, including sorting by variation in colour of the material.

Close attention is given to selective mining in the openpit by the mining staff and geologists. This work, and that of the electronic sorter, has increased production, despite loss of operating time of over 10 per cent. Overall mill recovery was 91.47 per cent. Since operations were commenced in 1958, the company has shipped 3,200,000 lb. of uranium oxide to the U.K.

The Mary Kathleen mine is situated in an extensive copper field, which has been worked intermittently in the past. It is reported that the Mary Kathleen company is considering investigation of the copper possibilities of the area. In view of the difficulties facing the uranium industry in the near future, the Commonwealth Government intends to extend the taxation concessions on the mining and treatment of uranium ore until June 30, 1968.

Equipment Digest

Zeiss announce the production of a new stereo-plotter, known as the stereo-metrograph. The apparatus is intended for the graphical and numerical single-model evaluation of vertical aerial photographs of practically all the customary sizes and focal distances. In order to keep the price moderate, and in view of the special purposes which this apparatus is intended to serve in mass production, devices for aerotriangulation have been dispensed with.

On the other hand, great importance has been attached to high precision, easy operation and to means for connecting up an automatic recording- and calculating-unit.

The Hazemag-impact crusher is available through Joy-Sullivan Ltd., in the U.K., and it is announced that the manufacture of spares will commence immediately, and that shortly complete units will be made in the U.K.

Fluid bed drying is now being employed for drying sand in the quarry industry and carrying out some degree of classification at the same time. Furthermore, in drying stone, the turbulence produced in the lower zone can be employed to dislodge adhering clay, and it is possible to use a two-stage operation, first drying, then agitating and cooling in the second stage, where the lower zone is static and final cobbing takes place.

Low fuel consumption, in some cases only half that of a direct fired rotary dryer, and high throughput is claimed, whilst low maintenance cost and easing of control are possible.

A new method of filtering poisonous nitrous fumes in mines permits heavier blasting schedules and provides added safety for miners, according to Zonolite Co., U.S. vermiculite producers. In the process, nitrous fumes given off in blasting operations are filtered through a bed of vermiculite impregnated with special chemicals. Expanded vermiculite, mined by Zonolite in Montana and South

Carolina, is a lightweight, fireproof, porous absorbent mineral, capable of holding chemicals in large quantities. Fume-laden air will pass readily through the properly sized material. Various gradations and treatments of the basic mineral have been developed to fulfill a variety of industrial requirements.

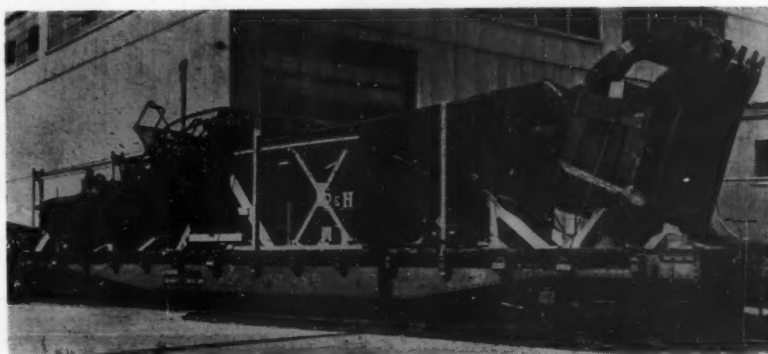
Vauxhall Motors is introducing a Bedford four-wheel-drive tipper chassis available with a standard 5 cu. yd. all-steel tipped body that gives it a payload capacity of over 6 tons. It is described as an ideal chassis for quarrying or open-cast mining. The tipper is offered with a choice of Bedford's own 300 cu. in. petrol units or with diesel power. Via a transfer box amidships, straight through drive to the rear axle only is alternative to a two-to-one reduction to the front and rear axles together.

Recent export shipments to Finland of British built Michigan tractor shovels and tractor dozers included Michigan model 275A (4½ cu. yd.—262 h.p.) tractor shovels. These are being used in a large limestone quarry at Lappeenranta in Western Finland.

The silicone grease MS4, used for protecting and insulating ignition systems and electrical equipment, is now being marketed in an aerosol pack, under the name Ambersil MS4, by Amber Oils Ltd. MS4, a product of Midland Silicones Ltd., has good dielectric properties, is highly water-repellent and oxidation-resistant, and has a working temperature range from -50 deg. C. to +200 deg. C.

Two new greases, one No-Melt and the other calcium based, are announced as an extension of their present range by Bardahl Products, Ltd. In addition to their original lithium based multi-purposes grease the company now offers these two further greases. The No-Melt grease is designed for use at unusually high temperatures and is capable of staying on bearings at temperatures up to 1,000 deg. F.

Ready for a 7,000 mile trip from Milwaukee, U.S., to western Liberia's iron ore mines is the first of a shipment of three 6-7 yd. capacity P&H electric mining shovels, made by Harnischfeger Corp. The machines will be used by the National Iron Ore Co. Ltd., a Liberian-owned firm, to work on the Mano River deposits, and are the first ever sold to Liberia by Harnischfeger. Illustrated is the excavating end of the excavator, which occupies only one of the five flat cars needed to move each machine to port



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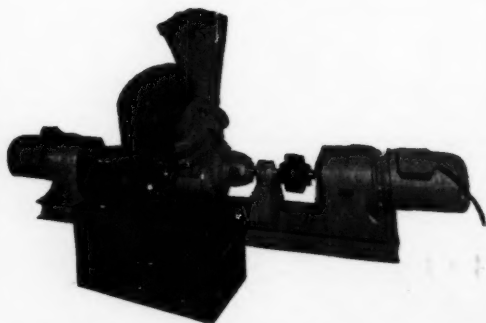
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MINING MISCELLANY

A total of 64 coal mines in the Stalino area of the Donbas, which have been in operation for 20 or more years, will be radically reconstructed by the end of 1967, says a report by Tass. It is estimated that it will be possible to increase their output by nearly 10,000,000 tons a year. The reconstruction work will only entail a fraction of the expenditure which would be involved in opening up 30 new mines of equal capacity. After reconstruction, many mines which have been in operation for 40 or 50 years will get a new lease of life. It will be possible to exploit them for several decades without any fall in output. Reconstruction will be based on new fundamental ideas and improved mining techniques, many of the mines will be equipped with high-speed hoists, noiseless automatically-controlled ventilators and powerful turbocompressors. Radical changes will be introduced in the underground haulage—transport will be replaced by a system of automatically controlled conveyor belts, and several mines will be switched entirely to hydraulic mining and coal-carrying techniques.

★

The LKAB Kiruna Mines in Northern Sweden broke their own production record in March. They achieved a total extraction of 1,210,000 tons of iron ore—the biggest output figure ever reached in one month. Of this quantity about 75 per cent was produced underground. The previous record, 1,140,000 tons, was made in November, 1960.

★

The 300 miners working from the French end of the Mount Blanc road tunnel have threatened to stop operations unless more effective safety measures are introduced. Since driving from the French end of the tunnel started two years ago there have been some 600 accidents, many trivial, but including four fatalities. The last fatal accident, caused by drilling into a charged shot hole, cost the lives of two men and precipitated a strike on that occasion. It is reported that the French Minister of Public Works is shortly to visit the tunnel to observe on security measures.

★

It is believed that the World Bank proposes to make a loan of Rs. 20 crores (£15,000,000) to India for mining equipment for both the public and private sectors of the mining industry but it will not be allocated to any specific projects.

★

The Glogow copper deposits of Poland are still virtually unexploited, but miners have drilled part of a ventilation shaft in the future Lubin mine, and preliminary work on the main shaft has begun. Expenditure on expansion of iron, zinc and copper mines this year will be 23 per cent higher than in 1960. Work has started on the construction of a zinc ore mine at Trzebieńka, near Chrzanów. Work is scheduled to start in 1963 on an important iron ore mining project at Zebiec, near Starachowice with a planned annual capacity of 400,000 tons of iron ore in 1965.



Artist's impression of the integrated copper and zinc extracting and fabricating plant to be built on Mindinao, in the Philippines. This operation has been mentioned in our issues of February 10 and April 7, 1961. Companies concerned in the establishment of the plant are Foster Wheeler Corp., prime contractor for the proposed project, and the E.W. Bliss Co., which will furnish its patented rolling and fabricating equipment for converting powder into strip, Chemetals Corp. of New York, 20 per cent of which is owned by Bliss Co., and Sherritt Gordon Mines, Ltd., of Toronto, which own and license the chemical reduction techniques. The Export-Import Bank of Washington has announced approval of a \$13,000,000 loan to Marinduque Iron Mines Agents, Inc., for construction of the proposed plant.

A borax deposit, estimated at 3,000,000 tonnes, has been located in the Emel area near Kutahya, Turkey. Etibank, which has been exploring reserves, is at present testing the first samples.

★

The Utica Mines, of Vancouver, Canada, intend to establish a subsidiary in Turkey to exploit seven concessions near Izmir for extraction of mercury. Fluorspar deposits at Sivas are also being studied.

★

A Japanese production of all ferro-alloys in the 1965 financial year of 668,200 tons has been forecast; this is a 47 per cent increase on the likely 1960/1961 figure of 460,000 tons. The alloy producers foresee little difficulty in finding domestic outlets, but they are not sure about the export pattern.

★

The value of West Germany's imports of ores and metal ash rose during 1960 to DM 2,344,000,000 from DM 1,628,000,000 in 1959, representing a rise to 5.5 per cent of total imports from 4.5 per cent in the previous year. Imports of non-ferrous metals and goods increased from DM 2,076,000,000 in 1959 to DM 2,971,000,000 last year or a rise from 5.8 to 7.0 per cent of all imports. Coal and coke exports rose from DM 2,036,000,000 to DM 2,308,000,000, although their share of total exports was virtually unchanged.

CHARTING U.K. COAL RESOURCES

The blue-print of the National Coal Board for the next generation is an output of all varieties of coal of around 200,000,000 tons per annum. Several hundred geologically distinct coal seams, some of them extending over hundreds of square miles, are either being worked or are potentially workable in the different coalfields of the country. Each seam is unique and each is variable. To date, the Coal Survey has obtained over 20,000 analyses of coal seams and several thousand additional measurements of seam sections.

The clearest way to present the findings of the Survey to those responsible for using them is in the form of maps and diagrams. Some 30 years ago it was considered that the Coal Survey had

amassed sufficient data to begin to map meaningfully the properties of the major coal seams of the country, and since then folios of maps of the characteristics of at least one seam from each of the nine Divisions of the Board have been compiled and printed and others are in the course of preparation. Sets of the maps were displayed to the Press at Hobart House on Tuesday. Each set of maps is supplemented by a table of representative analyses of the coal seam at different localities and by a text amplifying the information in the maps and dealing with matters relating to the seam that are not amenable to representation in a graphic form. It is estimated that about 180 seams are of sufficient importance to be treated in this manner.

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TURKISH CHROME BARTER AGREEMENT

An agreement has been reached between Turkey and the U.S. on the shipment of 200,000 tons of chrome ore from Turkey against shipments of American wheat and rice. Apart from this contract, however, the market is quiet and chrome ore stocks are being piled at the pitheads. Output of chrome in the private sector amounted to some 500,000 tonnes last year against 397,000 in 1959, according to provisional estimates.

U.S. USES LESS PLATINUM METALS

U.S. imports of refined platinum group metals in 1960 fell sharply to 647,008 oz. from 924,280 oz. in 1959, according to preliminary figures released by the U.S. Department of Commerce. Imports of platinum were 238,300 oz. (260,524), palladium 368,459 oz. (610,740), iridium 4,253 oz. (7,772), osmium 277 oz. (1,223), rhodium 31,722 oz. (29,342) and ruthenium 3,997 oz. (14,679). Imports of unrefined materials fell by more than 50 per cent to 33,834 oz. last year. Recovery of new and secondary platinum metals by U.S. refiners last year amounted to 113,373 oz. against 185,317 oz.

Total sales of the platinum group metals in 1960 amounted to 735,000 oz. about 14 per cent less than the year be-

fore, according to the U.S. Bureau of Mines. Sales of platinum decreased 11 per cent during the year, palladium sales fell 15 per cent and sales of iridium, osmium, rhodium and ruthenium were together 19 per cent lower than in the previous year. Imports of these metals last year were one-third less than in 1959.

In the fourth quarter of last year sales and transfers of platinum to domestic consumers were 3 per cent up on the preceding quarter. Palladium sales increased 5 per cent over those of the third quarter due to the sharp rise in purchases by electrical industries which more than offset the decline in sales to other industrial consumers. The aggregate quantity of iridium, osmium, rhodium and ruthenium sold for industrial and artistic use amounted to 7,280 oz., a rise of 44 per cent over the third quarter. The sales of rhodium, comprising about two-thirds of the total, showed a rise of 80 per cent.

U.K. ILMENITE IMPORTS

Westralian Oil Ltd., Perth, report having sent two shipments of high grade ilmenite to the U.K. since last December, amounting to 17,000 tons. Further shipments of 10,000 tons in April and 10,000 tons in July are on order. It is understood that plans are being prepared to extend a plant to extract zircon and monazite from the mineral concentrate which at present is being stockpiled.

NO. 2 SCRAP UP TO 24½ c.

Continental demand on balance continues satisfactory and there has been a marked improvement in buying interest in the U.S., so it is no surprise that copper prices should have made further headway during the week. To some extent this reflects normal inventory replacement undoubtedly prompted, at any rate partially, by the possibility of trouble in the middle of the year when the present labour contract at Kennecott's mines and refineries expires. Apart from this, scrap is in short supply due to substantial overseas purchases, mainly on Japanese and Continental account, which has resulted in an increase to 24½ c. in the smelter buying price for No. 2 wire. This represents a refined price of about 1 c. above the current electro quotation of 29 c. which points to an early increase in the quotation. A restraining factor, however, against such a movement is probably the absence of domestic demand for metal at a premium compared to the main producers' quotation.

During the week the Belgian price has been raised from 31 B.frs. per kilo to 31.75 B.frs. U.K. copper stocks in official warehouses increased 396 tons last week to 15,368 tons.

LEAD-ZINC MORE CHEERFUL

The lead market has been well maintained and in the absence of any substantial offerings, together with the more reassuring atmosphere following the conference in Mexico, sentiment has changed for the better with an improvement in consumer business. Duty free stocks of lead at the end of last week in official warehouses amounted to 7,814 tons, whilst bonded stocks were 3,686.

Improved conditions in the motor industry have helped the zinc market but, against this, U.K. supplies at present seem fully adequate. During the week the Board of Trade announced their intention of disposing of about 1,500 tons of zinc between May and October this year. This was not considered a market factor, as it is of a recurring nature.

U.K. duty free stocks at the end of last week totalled 4,078 tons and stocks in bond were 350 tons.

U.S. zinc statistics for March compared to February are (in tons) as follows:—

	March 1961	February 1961
Production	78,000	70,189
Total shipments	70,074	61,605
End of month stocks	222,889	214,956

In the U.S., demand for lead and zinc for galvanizing purposes has been satisfactory, whilst special high grade for die-casting purposes has only moved slowly.

Closing prices were as follows:

	April 6 Buyers Sellers		April 13 Buyers Sellers	
COPPER				
Cash	£226½	£226½	£230½	£230½
Three months	£228	£228½	£231½	£232
Settlement		£226½		£230½
LEAD				
Current ½ month	£66½	£66½	£66½	£66½
Three months	£67½	£67½	£67½	£68
TIN				
Cash	£828	£828½	£843	£844
Three months	£830½	£831	£848	£849
Settlement		£828½		£844
ZINC				
Current ½ month	£84½	£84½	£84	£84½
Three months	£84	£84½	£84	£84½

Copper • Tin • Lead • Zinc

(From Our London Metal Exchange Correspondent)

Although there have been no fresh developments of an outside nature during the period under review, it has been an active and interesting week on 'Change. Developments in the tin market were the main point of attention. The undertone of each metal remains very satisfactory and at present there seems to be nothing on the horizon to change our opinion that the present upward movement will be maintained in the coming weeks. Business has been at a good level and turnovers during the week, with the previous week's figures in parentheses (in l.tons) were:—

Copper	...	12,800	(9,250)
Tin	...	1,460	(625)
Lead	...	5,775	(7,800)
Zinc	...	4,475	(6,950)

IS TIN GOING TO £880?

The recent steady rise in both the London and Singapore tin quotations gained impetus during the week. Prices have surged ahead to break through the buffer stock manager's optional selling price of £830 and take values to the highest point since the latter part of 1956. This was prompted initially by the seasonal increase in demand from the tinplate industry, together with some inventory replacement. Coinciding with this there has been a growing appreciation within the trade that the estimated deficit of some 10,000 tons between probable supplies and anticipated demand will prove to be on the conservative side.

On the one hand, a number of reasons point to no marked increase in the availability of metal, whilst the drop in con-

sumption has probably been over-estimated. There is little doubt that the buffer stock manager has been offering tin on the London market, and the limited reaction here to a particularly sharp rise in the East one day was undoubtedly occasioned by selling on his account. In the present mood of the market a further rise must be expected, but at the same time the buffer stock manager will undoubtedly wish to take some action to prevent prices "running away". Prior to the end of last week his available supplies could be reckoned on at 10,500 tons; the utmost discretion will be required on his part to ensure that he is in a position to hold the market in the event of the obligatory selling price of £880 being reached. On Thursday the Eastern price was £870½ which represents a premium of £20 over the London nearby quotation.

Whilst the Canadian Government has announced its intention of disposing of its stocks of tin—amounting to about 2,000 tons—for consumption in Canada only, some 300,000 tons are believed to be held in the U.S. Government stockpile that can only be released under very rigid conditions and provided six months' notice is given to Congress. Other smaller stocks can be made available more easily. It is with this in mind that producers will be anxiously hoping that the buffer stock manager will succeed in controlling the price.

The British Bureau of Non-ferrous Metals Statistics show that consumption of tin in the U.K. during February was about 2 per cent lower at 1,760 tons compared to 1,803 tons in January. Stocks of tin in official warehouses last week increased 17 tons to 10,281 tons.

Mining Finance

Diamond Sales at New Record

The cutting down of information from any industry is always to be deprecated. So the decision by De Beers no longer to give separately the value of the sales of gem and industrial stones through its Central Selling Organization, which now handles rather over 80 per cent of world production can hardly be regarded with pleasure or enthusiasm by those who endeavour to follow market trends. De Beers is, however, in the happy position of being able to initiate this new form of presentation in a period (the first quarter of 1961) in which it is able to announce a new high record for the overall figure of diamond sales which at £24,302,251 compares with £20,396,151 for the first quarter of last year and with the previous peak of £23,586,653 attained in the first quarter of 1959, a year in which sales went forward to a new highest-ever annual total of £91,135,943. Last year gem sales reached a new high of £63,450,929, but the 1960 total did not quite come up to that of the previous year owing to a decline in industrial turnover.

The reason put forward by De Beers for no longer giving the two classes of stones separately is a revision of selling procedure as from last January which has "invalidated any comparison between current and earlier sales of gem and industrial diamonds and made any automatic classification of sales into gems and industrials impossible". However, in view of the growing competition in the

industrial sphere from the production of synthetic stones by General Electric in America taken in conjunction with De Beers' own entry into the field of synthetics, expected this summer, it would be understandable if the discontinuation of industrial diamond figures had come about partly for reasons of commercial strategy.

Meanwhile, the De Beers organization is running a promotion campaign for industrial diamonds aimed at giving as great a flexibility as possible in the applications of both natural and synthetic stones for specialized industrial needs. There is at the moment a much greater need to concentrate on selling industrials than gems. Business in the latter, so far as is known, is still limited mainly by the amount of stones available from the mines. It is notable that steps are being taken in Kimberley to re-open the old original De Beers mine which has been closed since 1908, as it is believed that with modern methods blue ground unpayable in those far-gone days will now be profitable.

In viewing the significance of the record March quarter sales it has to be borne in mind that for the first time they do not include the value of Ghana's output which as from January 1 last has been sold through the diamond market in Accra, a market that has been in existence for a number of years, but which up to the end of last year was not dealing with the production of the major

Ghana producer, Consolidated African Selection Trust, which was selling under contract to the De Beers organization. Obviously, if the U.S. economy has its much talked about revival, then the outlook for diamond companies is rosy.

ANGLO AMERICAN'S OLDER MINES

The annual reports and chairmen's statements have now appeared for five of the older South African gold mines in the Anglo American Corporation group and are reported on page 429.

Daggafontein. Of most interest therein are Mr. H. C. Koch's remarks about the future of Daggafontein, the Eastern Rand gold and uranium producer. The effect of the revised uranium contract will be to increase the distributable profits from this metal and from sulphuric acid over the period of the contract, that is to say until the end of 1963. This, Mr. Koch says, should mean maintenance of the dividend rate during this time at about the current rate of 4s. per 5s. share.

After that Daggafontein will have to rely for its earnings on gold production alone and in this context account has to be taken of the fact that at this stage of the mine's life, with a decreasing number of stope faces available for ore extraction, the crushing rate of 2,750,000 tons per annum is likely to decline. Nor will a gold price rise help all that much. Mr. Koch points out that zones of payability are clearly defined on both reef horizons and the falling off in values beyond these zones is very marked. In other words, there is "very little" marginal ore to become payable. On the other hand, of course, Daggafontein would benefit from increased revenue in the mining out of the remaining ore above the present day limit. Shares currently stand at 18s. 6d.

Sallies. The South African Land and Exploration company's mine, also in the Eastern Rand, would be able to extract "substantial" additional tonnages of ore profitably if the gold price should go up. Mr. Koch says. The Sallies mine is taking on a new lease of life with the opening up of the large Witthok area to the south of the old property. The new shaft here is expected to reach its final depth of 7,450 ft. during the second quarter of next year. When it is brought into operation it should help Sallies' costs considerably. These have been rising owing to the progressively greater distances that separate No. 1 shaft from available working faces.

Sallies has had to cut its dividend sharply to 1s. owing to the heavy capital expenditure involved in opening up Witthok—the new shaft system is estimated to cost £2,724,000—while in due course repayment of the £2,000,000 of Notes will have to be provided for. Against this a small amount of new capital will accrue in 1963 when Noteholders have an option on 800,000 3s. 6d. shares at par and Anglo American will take up another 25,000 shares also at par.

Even in the present depressed state of the Kaffir market Sallies stand at 13s. 9d., so these options should be valuable. Sallies £1 6 per cent Notes at 18s. 3d. look an intriguing and not very risky lock-up. The option to take up shares at par in August, 1963, is in the ratio of two shares for every £5 of Notes.

East Daggafontein. An increased gold price would make it profitable to mine "fairly extensive" additional reserves on both the Main Reef Leader and Kimber-

London Market Highlights

After plunging into what appeared to be the depths of despair, South African Gold shares made a strong recovery in highly sensitive trading conditions this week. Monday's weakness stemmed directly from the fact that Johannesburg, which for a long time now has tended to be a buyer, suddenly decided to unload stock on what could at best be described as a reluctant and nervous London market.

The result was a widespread marking down of share prices which included many losses of several shillings. Free State Geduld, for instance, tumbled by 4s. 3d. (after making allowance for the dividend deduction) to only 87s. 6d. xd., while Western Holdings plummeted a net 6s. 10½d. to 113s. 9d.

Johannesburg selling was a particularly weakening factor in shares of previous speculative favourites and because of this Loraine fell 2s. to a rather nominal 16s. 3d. In the finance section Anglo American came back 5s. to 125s. xd. and a similar loss was registered in De Beers at 124s. 4½d.

However, Tuesday produced a swift change of heart at the Cape and share prices rebounded back to the previous day's starting levels. The better tendency persisted during quieter dealings on Wednesday and Free State Geduld recovered to 93s. 9d. after touching 95s. while Western Holdings held steady at 120s. "Ofsits" which had been only 56s. 9d. on Monday, climbed back to 63s. 9d. and De Beers recovered to 130s. 7½d.

Rhodesian copper shares inevitably came under the shadow of Kaffirs, but

brightened later. The improvement was helped by a similar movement in copper shares on New York and by the firmness of the metal price; it was clear that sharemarket observers had been impressed by Sir Ronald Prain's comment that a U.S. business revival could alter the current top heavy statistical position of copper within a few weeks, although an even more important factor is still, of course, the Rhodesian political situation. Chartered which had tumbled to only 61s. 6d. in sympathy with their gold interests recovered to 64s. 3d., while Rhokana and Nchanga edged ahead a shilling or two to 44s. and 48s. respectively.

Imminence of the tin dividend season coupled with the gathering strength of the commodity price was mirrored by a strong demand from both London and Singapore for tin shares. A new crop of price "highs" was established each day and among the many sharp rises Sungei Besi climbed from 31s. 6d. to 36s. 3d., Tronoh from 45s. 6d. to 49s. 3d. and Malayan from 29s. 3d. to 32s.

While the scramble for Malayan tin shares was going on, the Nigerian issues were left completely out of the picture. Political considerations were largely to blame for this omission, but it is worth pointing out that Nigeria is one part of Africa where, politically speaking, all is running very smoothly. In view of the good yields offered, stocks such as Amalgamated Tin are worth consideration by those who feel that they have left it rather late to participate in the Malayan tin share boom.

ley reef at the old East Daggafontein property Mr. Koch estimates.

Brakpan is celebrating its fiftieth anniversary this year having milled 58,000,000 tons of ore for gold that has yielded a revenue of around £105,000,000. At this mine a gold price rise would not make a great deal of difference. It would be limited both by the small extent of present ore reserves and by the relatively small tonnage of additional ore that would be made profitable.

Springs. Finally, there would have to be a very substantial increase in the value of gold for Springs to derive much benefit because if the life were to be materially extended the expense of re-commissioning old shafts would have to be undertaken.

HIGHEST EVER GOLD PRODUCTION

The gold production for the month of March is the highest figure yet obtained. At 1,876.123 oz. it is 56,102 oz. above the previous record figure for January of this year. The native labour figures also show an increase and stand at the highest ever at 398,626.

Of the individual reports, Western Holdings is the most notable for a sharp increase in profits of over £50,000 to £992,937. The grade has been maintained at the same level but the tons milled has been increased by 10,000 tons. This has also had the effect of reducing the cost by 2d. per ton milled. Harmony has also showed an increased profit over the recent level at £563,759 but this is still below the record figure of last October.

The profit figures of both Buffelsfontein and Stilfontein are down on last month as a result of the new uranium stretch-out agreements. At Buffels allowance has been made, for the first time, for the outgoing royalty payments, whilst Stilfontein have now stopped producing uranium and have not shown any credit for royalty due. This royalty due is anyway a very small figure for the first few years of the new contract period.

GOOD PROSPECTS FOR RHODESIA BROKEN HILL

Mr. Harry Oppenheimer, chairman of Anglo American Corporation's Rhodesian lead-zinc mine, Rhodesia Broken Hill, is able in the annual report for 1960 to paint quite a rosy picture of the company's activities which is more than is possible for most heads of lead-zinc concerns in the present difficult marketing circumstances for these two metals. He starts off by saying that "we have been fortunate in being able to sell the year's output of 14,429 tons of lead and 29,794 tons of zinc as the greater part of our production continued to find a ready market in the Union of South Africa and in the Federation of Rhodesia and Nyasaland. The increase in our metal stocks at the end of the year arises mainly from zinc concentrates which are being held for treatment when the new Imperial Smelting furnace comes into operation".

So, Rhodesia Broken Hill not only has no sales troubles it is also for the very same reason not having to participate in any cutback programmes for these currently rather depressed metals. On top of this the installation of the new furnace is proceeding according to schedule.

(Continued on page 432)

Rand and Orange Free State Returns for March

GOLD OUTPUT AND PROFIT

Company	March 1961				Current Financial Year				Last Financial Year			
	Tons (000)	Yield (oz.)	Profit† (£000)	Year ends	Tons (000)	Yield (oz.)	Profit† (£000)	Total to date	Tons (000)	Yield (oz.)	Profit† (£000)	Total to date
Gold Fields												
Doornfontein	115	47,530	263.6	J	965	398,780	2157.9	850	345,812	1710.6	850	345,812
Libanon	117	28,542	75.1	J	1,051	252,915	644.6	999	235,343	357.0	999	235,343
Rietfontein	12	3,276	2.0	D	36	9,700	4.4	48	12,625	20.8	48	12,625
Robinson	42	9,643	0.7	D	124	28,880	4.3	139	28,378	119.9	139	28,378
Simmer & Jack	69	12,728	1.0	D	209	38,024	0.0	234	40,934	144.1	234	40,934
Sub Nigel	66	15,026	12.8	J	594	135,351	128.6	594	139,220	171.4	594	139,220
Venterspost	125	36,263	89.9	J	1,088	308,242	706.3	1,117	283,116	518.5	1,117	283,116
Vlakfontein	52	19,428	93.0	D	154	56,785	275.4	153	54,683	258.6	153	54,683
Vogels	81	17,322	13.0	D	243	51,927	45.0	260	55,597	64.7	260	55,597
West Drie	130	121,614	1057.9	J	1,170	1,101,250	9723.8	970	888,679	7548.7	970	888,679
Anglo American												
Brakpan	142	18,019	20.0	D	425	52,779	54.9	422	51,122	34.0	422	51,122
Daggas	229	46,324	230.1	D	671	135,828	671.6	693	139,458	684.0	693	139,458
East Daggas	108	18,460	42.0	D	320	54,690	127.9	311	52,582	118.3	311	52,582
F.S. Geduld	97	84,747	683.1	S	570	495,983	4049.8	560	479,220	3839.0	560	479,220
President Brand	123	96,533	826.1	S	712	564,112	4923.1	687	562,350	4945.1	687	562,350
President Steyn	108	40,533	165.0	S	638	238,478	1025.8	604	237,500	1086.2	604	237,500
S.A. Lands	107	21,583	50.5	D	310	63,369	130.2	284	59,029	125.2	284	59,029
Springs	94	12,967	15.0	D	278	38,374	44.4	311	43,173	45.5	311	43,173
Vaal Reefs	105	49,057	267.7	D	308	144,454	784.0	278	125,100	647.5	278	125,100
Welkom	99	31,410	56.0	S	585	184,952	406.8	577	181,979	421.6	577	181,979
Western Holdings	170	116,875	993.0	S	956	653,967	5600.4	853	561,931	4618.9	853	561,931
West Reefs Ex.	150	43,501	147.3	D	429	124,412	407.7	400	112,472	364.5	400	112,472
Central Mining												
Blyvoor	139	90,002	682.2	J	1,203	780,555	5962.1	1,148	752,231	5693.8	1,148	752,231
City Deep	113	23,690	4.0	D	338	69,948	13.6	331	69,888	17.2	331	69,888
Cons. M.R.	48	10,048	3.0	J	458	97,195	31.0	785	149,935	63.1	785	149,935
Crown	193	33,326	1.5	D	559	97,021	4.7	615	101,752	29.8	615	101,752
D. Roodepoort	193	35,622	50.7	D	562	103,266	147.9	571	104,246	150.3	571	104,246
East Rand Prop.	235	52,324	61.5	D	695	153,431	177.7	652	166,940	281.7	652	166,940
Harmony	186	75,808	370.6	J	1,540	623,967	2950.0	1,284	511,851	2266.3	1,284	511,851
Modder East	59	6,568	1.3	J	865	88,809	6.0	1,221	119,267	7.3	1,221	119,267
Rose Deep	23	4,216	0.5	D	69	12,464	4.1	80	13,225	3.2	80	13,225
J.C.I.												
Freddies Cons.	64	13,529	127.5	D	184	39,624	181.8	173	39,410	131.0	173	39,410
Govt. G.M.A.	42	9,244	13.9	D	138	27,965	11.8	159	32,286	1.6	159	32,286
Randfontein	18	3,124	0.6	D	51	9,352	2.6	67	12,667	9.3	67	12,667
Union Corporation												
East Geduld	130	37,050	224.8	D	380	108,926	665.7	401	118,089	772.6	401	118,089
Geduld Prop.	80	12,406	20.4	D	235	37,412	68.4	222	40,602	82.6	222	40,602
Grootvlei	215	44,537	211.8	D	640	132,516	649.9	645	134,706	695.1	645	134,706
Marievale	99	23,859	121.5	D	290	70,367	364.9	297	72,685	374.1	297	72,685
St. Helena	182	64,155	409.0	D	530	185,949	1190.9	460	153,333	930.4	460	153,333
Van Dyk	73	11,632	7.8	D	216	34,415	18.3	215	36,742	33.7	215	36,742
Winklaars	94	31,961	171.2	D	279	95,088	518.1	242	74,345	319.5	242	74,345
General Mining												
Buffelsfontein	150	66,028	379.9	J	1,329	556,520	3099.0	1,285	496,495	2582.9	1,285	496,495
Ellatton	25	5,862	18.4	D	76	17,660	53.5	83	19,738	72.4	83	19,738
S. Roodepoort	29	6,955	20.4	J	266	64,177	202.9	269	64,111	204.3	269	64,111
Stilfontein	175	79,400	428.1	D	517	235,206	1282.0	454	204,430	1048.4	454	204,430
W. Rand Cons.	138	20,116	14.9	D	391	57,187	35.0	373	52,768	2.2	373	52,768
Anglo Transvaal												
Hartebeestfontein	131	60,260	333.4	J	1,114	517,464	2961.9	877	437,145	2657.6	877	437,145
Lorraine	82	21,730	1.1	S	490	116,090	151.9	457	94,439	129.2	457	94,439
N. Klerksdorp	10	1,294	1.2	D	30	4,033	1.6	32	3,702	1.7	32	3,702
Rand Leases	194	26,481	14.1	J	1,687	238,225	35.0	1,664	249,011	215.5	1,664	249,011
Village M.R.	36	4,110	1.3	J	276	37,706	128.4	272	42,089	7.2	272	42,089
Virginia O.F.S.	130	26,767	160.4	J	1,105	234,135	1262.3	1,187	270,511	125.2	1,187	270,511
Others												
N. Kleinfontein	75	10,324	3.7	D	219	29,949	9.7	238	30,544	3.3	238	30,544
Wit. Nigel	20	4,272	3.7	J	179	39,384	45.8	168	39,268	46.7	168	39,268

Gold has been valued at 250s. 4d. (February 250s. 7d.) per oz. fine. L indicates loss. † Working Profit. Tables exclude profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Randfontein and W. Rand Consolidated.

ESTIMATED URANIUM REVENUE

Company	Year ends	March Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)	Company	Year ends	March Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)
Goldfields					J.C.I.				
Doornfontein	J	16.0	132.5	134.0	E. Champ d'Or (a)	D	4.8*	15.5*	21.1*
Luipards Vlei (a)	J	120.0	893.2	887.8	Freddies Cons. (b)	D	32.5*	97.0*	92.0*
Vogels	D	56.0	162.5	165.0	Govt. G.M.A. (c)	D	21.0*	67.0*	69.2*
West Drie	J	51.0	443.0	448.0	Randfontein (b) (c)	D	139.9*	412.9*	330.2*
Anglo American					General Mining				
Daggafontein (b)	D	134.0	394.5	418.6	Buffelsfontein (d)	J	131.5	1,792.5	1,902.0
P. Brand (b)	S	45.2	264.9	278.6	Ellatton (d)	D	—	5.0	52.0
P. Steyn (b)	S	62.0	366.6	365.8	Stilfontein (d)	D	—	97.5	273.0
Vaal Reefs (b)	D	71.5	221.9	431.9	W. Rand (c) (d)	D	170.6	523.7	630.6
Welkom (b)	S	58.8	349.6	348.0	Anglo Transvaal				
West Reefs Ex. (b)	D	48.5	149.6	488.2	Hartebeestfontein (d)	J	241.0	2,128.0	2,355.6
Central Mining					Lorraine (d)	S	35.0	204.0	215.0
Blyvoor (b)	J	160.0	1,413.5	1,367.2	N. Klerksdorp (d)	D	12.5	33.5	32.0
Harmony (b)	J	193.2	2,091.8	1,805.4	Virginia O.F.S. (d)	J	152.2	1,535.6	1,593.4

Tables include profit from uranium acid and pyrite before loan redemption. (a) Including profit from gold section. (b) Includes royalty provision. (c) Total profit from uranium section. (d) Excludes royalty provision. * Net revenue.

ANGLO AMERICAN CORPORATION OF SOUTH AFRICA LIMITED

Extracts from the Statements by Mr. H. C. Koch, Chairman of THE GROUP'S RAND GOLD-MINING COMPANIES

(All companies mentioned are incorporated in the Union of South Africa)

Brakpan Mines Limited

TOWARDS the end of 1960 the demand for gold on the London bullion market resulted in significant premiums over the sterling equivalent of \$35 per fine ounce. As a result the average price received for our gold in 1960 was 250s. 8d. per fine ounce, an increase of 1s. 4½d. over the price realized in 1959.

Without the successive increases in the price of gold, mining would have ceased to be economic on the company's property many years ago. However, the benefit that would be derived from any further rise in the price of gold would be limited both by the small extent of present ore reserves and by the relatively small tonnage of additional ore that could be rendered profitable.

The results of mining operations during 1960 were most satisfactory, and the higher milling rate and the additional price received on the sale of gold increased the working profit for 1960 to £165,000 as compared with £128,000 in 1959.

As must be expected after fifty years of intensive mining, the areas in which it is possible that development might disclose additional reserves are very limited. Exploratory headings driven at No. 2 Shaft during the year delineated further payable extensions to the foot-wall reef. Development at No. 3 Shaft was undertaken on the Main Reef Leader horizon in the immediate vicinity of the shaft and was confined mainly to the preparation of the shaft pillar which will be mined out during the current year. The balance of development took place in the strip of ground lying to the south of Nos. 5 and 6 Shafts and flanked on either side by the lease areas of the South African Lands and Van Dyk companies.

Recalculation of the ore reserves at the year end revealed a decrease in tonnage from 1,593,000 to 1,340,000 accompanied by a small increase in grade to 4.9 dwt. per ton. Tonnage available in surface dumps has not been included in the ore reserve.

The company continues to hold 315,000 shares and £252,000 of 6 per cent notes in The South African Lands company. As was foreshadowed in that company's announcements dealing with proposals for the opening up of the Wit-hok property, dividends paid in 1960 totalled 1s. per share as compared with 1s. 9d. in 1959. However, the reduction in our company's dividend income from this source was offset by the interest earned on its holding of the 6 per cent notes. It is the intention to retain for the present the investment in The South African Lands company.

The working profit for 1960, together with the excess of sundry revenue over

expenditure for the same period, the unappropriated balance brought forward from 1959 and amounts arising from the sale of fixed assets, brought the total available for appropriation at the end of the year to £559,732. The government's share of the profits and taxation absorbed £23,254 and, of the balance, £201,250 was transferred to reserve in connection with the second and third repayments of capital to members, totalling 10½d. per share. The remainder, amounting to £335,228, was carried forward as unappropriated profit in 1961.

Daggafontein Mines Limited

NEARLY the whole of the tonnage drawn from the Main Reef Leader horizon, which provided slightly more than half the tonnage milled in 1960 was mined from haulage pillars which are being extracted systematically now that the ground they once served has been mined out. On the Kimberley Reef normal stopping operations were continued in the northern and eastern portions of the lease area.

In the face of the difficulties associated with the gradual withdrawal taking place on the Main Reef Leader horizon, the maintenance of the high milling rate and low cost per ton milled is a tribute both to the planning of the mine management and the consulting engineers and to the cooperation and initiative of the employees in carrying out plans.

It must, however, be clear that the time has come when the milling rate, which has been maintained at about 2,750,000 tons per annum for the last 12 years, will begin to decline to a figure more in keeping with the smaller number of stopes now available. This has been foreshadowed by the gradual decrease in the ore reserves over recent years to 7,576,200 tons at the end of the year under review.

Towards the end of 1960 arrangements were concluded in terms of which the deliveries of South African uranium oxide, previously to be made over the period to the end of 1966, have now been stretched out over the ten-year period to the end of 1970. Under the new arrangements, producers will receive fixed prices for their uranium, related to the prices received in 1960 in terms of the old formulae.

The stretch-out arrangements, which have the general advantage of enabling low cost producers to remain in production during a period when it is anticipated that supply will exceed demand were made possible by the lowering of the average production costs within the industry, which was achieved by the transfer of production quotas from high to low cost producers.

This company, being a relatively high cost producer transferred the right to produce portions of its annual quota, amounting in total to 378 tons over three years, to Vaal Reefs Exploration and Mining Company, Limited, for a royalty of 52s. per lb. of quota transferred. Payments will be effected to our company over the period of its original contract and, in respect of the quota transferred, will be sufficient to enable the company to meet its obligations under the loan arrangements and will ensure that profits before taxation will be not less than they would have been had the company continued to produce the full quota in terms of the previous arrangements and under conditions prevailing in 1960. In terms of existing tax legislation royalty payments are taxable at the non-mining company rate which, for 1960, was 6s. 0d. in the £.

Under the old arrangements the uranium plant was fed partly with medium grade current and reclaimed Kimberley Reef slimes, and partly with the Main Reef Leader concentrates produced in the South flotation plant.

Under the new arrangements for the production of a total of only 471 tons, over three years, the Kimberley Reef slimes will first be upgraded in the North flotation plant. The uranium leach plant will thus treat concentrates from both reefs, and it is anticipated that this will result in the unit cost of uranium oxide being reduced below the figure in 1960 when the full quota was produced. The estimated cost of reorganizing the production on these lines will be £20,000.

The overall effect of these new arrangements will be to increase the distributable profits attributable to uranium oxide and sulphuric acid which will accrue over the period of the old contract, namely until the end of 1963. It therefore seems likely that the company will be in a position to maintain dividend payments at about the current rate during the period that profits from uranium continue to accrue. Thereafter amounts available for distribution will depend on profits from gold production, which, for the reasons indicated earlier in this review are likely to be lower than they have been in recent years.

The price received by the company for gold sold by the South African Reserve Bank is related to the price of the metal determined by dealings in the London bullion market. During the last quarter of 1960, the demand for gold in this free market caused the price to exceed the sterling equivalent of the fixed dollar price of \$35 by significant margins. The average monthly price received for our gold in 1960 was 250s. 8d. per fine ounce, an increase of 1s. 4½d. over the average price realized in 1959, and as a conse-

quence the company's working profit was approximately £38,000 higher than it would otherwise have been.

Zones of payability are clearly defined on both reef horizons and the falling off in values beyond these zones is very marked. Were there to be an increase in the price of gold very little marginal ore would become payable, and the benefits would, therefore, consist almost entirely of an increase in revenue from the mining of ore above the present pay limit.

The working profit from the production of gold and the estimated profit from uranium and sulphuric acid for 1960 totalled £4,327,765. Sundry revenue exceeded sundry expenditure by £154,159 making the surplus for the year £4,481,924, which, with the addition of the unappropriated profit for the previous year, brought the amount available for appropriation to £4,914,389. The Government's share of profits and taxation absorbed £2,470,125, and £477,666 was appropriated for capital expenditure. Of the balance, a total of £1,400,000—equivalent to 4s. per share—was distributed, as compared with £1,575,000 or 4s. 6d. per share distributed for the previous year.

East Daggafontein Mines Limited

A STUDY of the company's recent history discloses a sharp reversal in 1959 of the previously declining trend in the milling rate. This recovery was maintained during 1960 when a record total of 1,270,000 tons was treated in the reduction plant to yield 215,874 fine ounces of gold worth £2,706,000.

Careful control of working costs is of special importance in a low grade mine and it is therefore pleasing that unit costs were reduced from 35s. 3d. per ton milled in 1959 to 34s. 11d. in 1960. Since the year end, the K.R.2 Haulage has been completed and now provides direct access from No. 1 Shaft to the Kimberley Reef reserves in the eastern section of the mine. This new haulage should promote greater efficiency in this section, with resultant savings in working costs.

In the latter months of 1960 the demand for gold on the London bullion market caused the free price of the metal to rise to levels significantly higher than the fixed dollar price of \$35 per fine ounce. The prices received by this company for the sale of its gold are related to the prices determined on the London market and in the last quarter of 1960 the company's profit was accordingly £15,000 higher than it would otherwise have been.

Because of the large tonnages of marginal ore and the gradualness of the fall in values from pay to unpay sections, any permanent and appreciable increase in the price of gold would make it profitable to mine fairly extensive additional reserves on both the Main Reef Leader and the Kimberley Reefs.

The development programme in 1960 followed the same lines as the programme undertaken in the previous year. Approximately three-quarters of the footage driven was developed on the Kimberley Reef and the balance on the Main Reef Leader. A total of 18,260 feet was sampled on both reefs, of which 4,925 feet equal to 27 per cent proved payable at an average of 311 inch-dwt.

Exploratory work on the Kimberley Reef in the vicinity of the old Rietfontein Shaft continued to disclose satisfactory values in a number of isolated patches of payable reef. Further work is being done to determine the extent of the payable sections in this area. Development towards the middle of the common boundary of the old Rietfontein property opened up further zones with satisfactory values, but with payability lower than in 1959. It should, however, be borne in mind that erratic payability is a feature of the Kimberley Reef.

With the exception of a limited footage driven with satisfactory results in the north-western corner of the old Rietfontein property, development on the Main Reef Leader was mainly confined to the opening up of already proven blocks of ore.

The increase in the tonnage milled and the higher average price received for gold led to the improvement of the working profit to £493,952, as compared with £403,006 in 1959. The total available for appropriation at the year end was £737,655. Taxation absorbed £200,453 and amounts of £6,032 and £8,000 were appropriated for capital expenditure and directors' special remuneration respectively. An amount of £256,437 was appropriated for the payment of dividends totalling 1s. 4½d. per share as compared with 1s. 3d. per share in 1959. The unappropriated profit of £266,733 was carried forward to 1961.

Springs Mines Limited

AS must be expected in the closing stages of the mine's life, there was a further decline in the tonnage milled during 1960. Certain favourable factors, however, combined to increase the working profit for the year to £174,919, as compared with £163,502 in 1959.

Following the strong demand for gold on the London bullion market towards the end of 1960, the price of the metal rose to levels significantly above the sterling equivalent of the fixed dollar price of \$35 per fine ounce. As a result, the average price received for gold during 1960 was 250s. 8d. per fine ounce, an increase of 1s. 4½d. over the average price realized in 1959.

The company has also continued to enjoy the benefits of the economies in working costs resulting from the closure of the East reduction plant.

Another benefit accruing to the company in 1960 was the further reduction in the annual pneumoconiosis contribution to £25,495, as compared with £35,897 in 1959.

With the contraction of mining operations active steps are being taken to realise capital assets no longer required by the company. During 1960, the sale of such assets realized £9,725. This, together with amounts accruing from the sale of property and trade investments, released £13,980 previously appropriated for capital expenditure, which has now been written back into the appropriation account.

The working profit for 1960, together with the excess of sundry revenue over expenditure for the same period, the unappropriated balance brought forward from 1959, and the above mentioned amount arising from the sale of fixed assets, brought the total available for appropriation at the end of the year to

£450,618. The Government's share of the profits and taxation absorbed £45,897. Of the balance, £252,750 was transferred to reserve in connection with the second repayment of capital to members of 6d. per share declared in December, 1960. The remainder, amounting to £151,971, was carried forward as unappropriated profit into 1961.

The company's available ore reserves are being depleted rapidly, as is evidenced by their decrease from 1,171,000 tons at the end of 1959, to 615,000 tons at the end of the year under review.

Strenuous efforts continue to be made to develop extensions to the existing sources of payable ore, and in 1960 no fewer than 20,031 feet were driven in exploratory work, compared with 14,212 feet driven in the previous year. This development was confined to the south-west portion of the lease area served by Nos. 5 and 7 Shafts, which are the only shafts remaining in operation. Should there be any revaluation of gold in terms of world currencies it seems likely that the additional ore that could be mined by our company would be limited to those small marginal reserves occurring in the areas served by Nos. 5 and 7 Shafts. The recommissioning of any of the company's other shafts would entail expenditure that would only be justified by a very substantial increase in the price of gold.

The South African Land and Exploration Company Limited

DURING the past three years the benefits of annual increases in working revenue have been offset by the rising trend in working costs. Thus although the working revenue in 1960 was higher than in 1959, the working profit at £558,140 was £86,355 lower. The rising costs are largely a reflection of the progressively greater distances that separate No. 1 Shaft from available working faces as the ore reserves closer to the shaft become exhausted. This situation cannot be expected to improve until the new No. 3 Shaft system and the high-speed haulage ways connecting it with No. 1 Shaft are completed.

In August, 1960, the twin high-speed haulages had been driven to the position from which the sub-vertical section of the No. 3 Shaft system will be sunk. The high-speed development crews are to be congratulated on driving each of the twin haulages a distance of nearly two miles in only ten months. The ventilation component of the shaft system has recently been completed to its final depth of 4,270 feet and the sinking of the sub-vertical shaft is due to be started early in the second half of the current year. It is anticipated that the shaft system will be completed to its final depth of 7,450 feet below surface during the second quarter of 1962.

The inclusion in the 1960 development figures of 18,153 feet driven off reef in the twin high-speed haulages is reflected in the higher total of 36,209 feet developed in the old lease area. Most of the footage driven on reef in this area was developed in the southern portion and disclosed payability and values approximately the same as in the previous year. Development in the Witbok area was confined to the central and eastern sections lying to the north of the Vogels

tear fault. Sampling in the north-eastern corner of the property continued to reveal encouraging values and payability, and satisfactory results were obtained in reef drives developed from the south and main cross-cuts on 72 Level. Until ventilation conditions are eased upon the completion of the No. 3 Shaft system, it is not planned to undertake further development in the area south of the Vogels tear fault.

The year-end recalculation disclosed unimportant alterations in the ore reserve which was estimated to be 3,344,300 tons at an average value of 6.13 dwt. per ton. Included in the new ore reserves was a total of 577,100 tons, with a value of 8.36 dwt. per ton, blocked out in the Witthok area.

During the last quarter of 1960 the price of gold on the London bullion market reacted to the firmer demand for the metal by rising to levels significantly higher than the sterling equivalent of the fixed price of \$35 per fine ounce. As a result the company's revenue from gold sales was approximately £18,000 higher than it would otherwise have been. If there were to be an upward revaluation

of gold in terms of the world currencies, substantial additional tonnages of ore could be mined at a profit. Furthermore, to such extent as a revaluation of gold might result in lengthening the profitable lives of neighbouring mines, there would be postponement of the time when the entire flow of water from their workings would have to be pumped to surface by this company. By the end of the year approximately two-thirds of the additional pumping equipment designed to deal with the increasing flow of water from neighbouring mines had been installed at a cost of £407,599.

The final cost of the new shaft system, the connecting cross-cuts on 40 Level and the additional pumping equipment has been estimated at £2,724,000. Of this amount, £489,951 was spent in 1959 which was reflected, together with other capital expenditure not then permanently financed, in an excess of expenditure on fixed assets over funds provided of £1,141,797 at December 31, 1959. Capital expenditure during 1960 amounted to £731,050. In February, 1960, the company received £2,000,000 as the proceeds of the issue of its 6 per

cent unsecured notes less expenses of the issue amounting to £58,141. An amount of £500,000 was appropriated from the 1960 profits towards the financing of the balance of the capital expenditure programme and at December 31, 1960, funds raised exceeded expenditure on fixed assets by £569,012. It is estimated that capital expenditure will absorb £950,000 in 1961.

The total amount available for appropriation was £848,656. Taxation and the government's share of profits absorbed £12,802 and directors' special remuneration £3,688. After providing for these appropriations and for the £500,000 appropriated towards capital expenditure, a balance of £332,166 was available for distribution.

In view of the company's heavy capital commitments over the next few years and the need to provide thereafter for the repayment of the notes, dividends declared during the year were reduced to a total of 1s. per share, absorbing £123,750 as compared with 1s. 9d., absorbing £216,563, in the previous year. The unappropriated balance carried forward to 1961 amounted to £208,416.

Personal

Mr. A. W. Girling has been appointed to the board of Aveling-Barford as director in charge of production. Mr. Girling had previously been a director of Aveling-Barford Australia Pty.

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Renold Chains announce that their home sales manager, Mr. J. A. Ford, has been appointed sales director of Renold Chains (Sales) Australia Pty., and will be leaving for Australia next June. Mr. F. T. Stanford will become home sales manager, and Mr. A. E. Clough has been appointed commercial sales manager (home), in succession to Mr. Stanford.

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Mr. Erwin Gammeter, a vice-president with Paul Weir Co. Inc., has returned to Chicago after serving 27 months as head of the firm's coal mining mission in South Korea. A Paul Weir Co. team formed the mining portion of a joint industrial group supplying technical assistants to the government of the Republic of Korea.

COLONIAL DEVELOPMENT CORPORATION

requires
A MILL
SHIFT BOSS

for work on a gold mine in East Africa. Applicants must have experience in operation and maintenance of crushing plant, rod and ball mills, some experience in flotation also desirable. Inclusive salary £1,150 per annum; tours 24-27 months with paid leave; pension scheme; free passages, housing and medical attention. Family not to accompany in first instance.

Apply in writing, quoting Serial 479, giving full personal particulars and details of experience to

Personnel Officer,
Colonial Development
Corporation.

33 Hill Street, London, W.1.

Graduate Assistant Mill Superintendent looking for job with gold, tin or other mining company. Available immediately. Box No. 693. *The Mining Journal*, 15 Wilson Street, London, E.C.2.

UNDERGROUND MINE MANAGER

Applications are invited for the position of UNDERGROUND MANAGER at KONONGO GOLD MINES LTD., GHANA, milling approximately 7,000 t.p.m.

Salary commensurate with qualifications and experience. The contract is continuous with three months' leave on full pay after each tour of 12 months. The company provides free accommodation, pays the passage outwards and homewards, and operates a Provident Fund.

Applications stating age and experience to The Secretary, Konongo Gold Mines Ltd., 49 Moorgate, London, E.C.2.

GEOLOGICAL SURVEY AND MUSEUM (D.S.I.R.), London, S.W.7, requires GEOPHYSICISTS as Experimental Officers and Assistant Experimental Officers. Duties mainly concern outdoor geophysical surveys anywhere in the United Kingdom. Quals.: (E.O.) Pass degree or equiv. in Geology with ancillary Physics or Maths., or in Physics or Maths. with Ancillary Geology. (A.E.O.) —G.C.E. "A" level in Geology, Maths. or Physics, and in another science subject. Over 22, pass degree expected. Salary ranges:—E.O. £1,147-£1,396; A.E.O. £503 (age 18)—£856—(age 26)—£1,038. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting G.98/1A.

The Proprietors of British Patent No. 700,577 for "IMPROVEMENTS IN OR RELATING TO PIT-PROPS AND SIMILAR STANCHIONS", desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

RHODESIAN SELECTION TRUST GROUP OF COMPANIES

GEOLOGIST/ GEOCHEMIST

Applications are invited from suitably qualified persons for employment in field mineral exploration in the BECHUANALAND PROTECTORATE.

Limited field experience acceptable but important that applicant should be fully conversant with wet method geochemical analytical techniques.

Commencing salary within the range of £1,300 to £1,750 per annum according to qualifications and experience. In addition, a proportionate field allowance at the rate of £15 per month and also a 5 per cent annual bonus is payable.

Leave is granted according to salary scale at the rate of four or six weeks per annum which may be accumulated up to twelve or eighteen weeks over a period of three years.

Pension, life assurance and medical aid schemes are also available.

Applications in the first instance to the:—

Personnel Officer,
Rhodesian Selection Trust
Exploration Limited,
P.O. Box 1479, Salisbury,
Southern Rhodesia.

MINING FINANCE—Continued

Most of the construction is taking place this year and the plant is expected to start up early in 1962.

R.B.H. has also been fortunate in benefiting at exactly the right moment from an amendment to the Federal Income Tax Act which increased capital redemption allowances from 5 to 10 per cent per annum from April, 1959. As Mr. Oppenheimer points out "the accelerated allowance facilitates the provision of capital, by the retention of profits, for the major increase in our operations which we are undertaking as it reduces our liability for taxation during the period of considerable expenditure on the installation of the new plant".

With a further increase in its ore reserves to aid the big production increase that should stem from the new furnace, R.B.H. thus faces, politics apart, a promising future which makes it difficult to come to any other conclusion than that the 5s. units at 7s., to give a generous yield of over 10 per cent on a well-covered dividend of 9d., could quickly go up by, say, 50 per cent whenever the Rhodesian mining share market manages to move out of its present political gloom.

UNION MINIERE'S LOWER DIVIDEND

Although Union Minière's copper production in 1960 was a record at 300,704 tonnes, an extraordinary effort in view of all that went on in the Congo during that year, and the company may have done as well as in the preceding twelve months, it was hardly to be expected, in the present continued state of instability in that country, that the directors would feel like being generous dividend-wise. So, the final now declared of 900 Belgian francs brings the total distribution up to 1,500 francs compared with 2,200 francs in 1959.

This means that Tanganyika Concessions' revenue from its holdings in Union Minière, a major source of income, will be cut by quite a considerable amount in the former company's year to July 31 next, but this does not necessarily mean that "Tanks" will reduce its own dividend which was kept at 3s. 9d. per 10s. stock unit for 1959-60 despite considerably higher earnings. The chairman, Captain Charles Waterhouse, said at the time that this cautious policy was engendered by the events in the Congo and by the desirability of building up funds for new projects. Much is going to depend, of course, on the situation in the Katanga Province of the Congo when "Tanks" final dividend comes to be decided next October. The interim for 1960-61 is due next month.

Dr. J. M. Holm Nobel Chairman.—Several changes on the board of I.C.I. Nobel Division are announced. Dr. James Craik, chairman of the Division since 1955, has retired and is succeeded by Dr. John M. Holm. Dr. Holm is succeeded as a joint managing director by Dr. A. D. Lees, whose position as production director is to be taken by Dr. J. Bell, the Division's engineering and technical director. Mr. J. A. Lofthouse has been appointed to the board and will succeed Dr. Bell. Dr. J. S. Flanders follows Mr. A. D. McLean as the Division's home sales control and technical service director. Mr. McLean is joining I.C.I.'s Heavy Organic Chemicals Division as commercial director.

Publications Received

The Yearbook of the United Nations, 1959, published by the Columbia University Press in collaboration with the U.N., gives an account of the main activities of the Organization, the U.N. specialized agencies and the International Atomic Energy Agency. Its contents include a report of the first year's operations of the U.N. Special Fund set up to speed economic advancement in the less-developed countries, and a detailed analysis of the countries providing, as well as receiving, aid through the U.N. technical aid programmes in 1959. The 1959 Yearbook, pp. 660, price £4 10s. (\$12.50), may be obtained from H.M. Stationary Office, P.O. Box 569, London, S.E.1, or from Columbia University Press, New York.

The sixth edition of **World's Non-Ferrous Smelters and Refineries, 1960** edition, is now available from Quin Press, Price £4. This reference book, which includes a classified guide to metals and alloys produced, is edited by H. G. Cordero, foreign editor of *Metal Bulletin*, and reviews over 700 companies in 60 countries. A new feature, "Directory of non-ferrous metals and alloys producers" has been added, and the 450 page book is designed to aid speedy reference.

The U.S. Department of the Interior have published their **Geological Survey Research Papers for 1960**, as two separate chapters of Professional Paper 400. Results of the investigations reported relate to all 50 States, many foreign areas, and Antarctica. Chapter A, published as a separate volume, is a synopsis of a wide variety of geologic studies; Chapter B consists of 232 papers by different authors. Copies of Professional Paper 400-A and 400-B are available from the Government Printing Office, Washington 25 D.C. at \$1 and \$4.25, respectively.

The routine mapping and prospecting in the Petauke and Sasare areas, Northern Rhodesia, results of which are given in Report No. 14, of the Ministry of Labour and Mines Geological Survey, under the title *Graphite of the Petauke District, Eastern Province* by A. R. Drysdall, revealed the presence of previously unsuspected graphite mineralization of disseminated flake type. While the individual deposits are limited in extent and of variable nature, they are so closely grouped and of apparently good quality, that exploitation might be possible, if transportation cost and other factors prove favourable. This Report of 28 pages, is obtainable from the Ministry of Labour and Mines in Lusaka, Price £1 1s.

The value of uranium produced in 1959 in Canada, for the second consecutive year, was greater than of any other mineral except petroleum. In *A Survey of the Uranium Industry in Canada, 1959* by J. W. Griffith, the Mineral Resources Division give a developments summary for 1959, and include some work undertaken up to the end of September 1960, and estimates for future production. Statistics are given on the year's production, ore reserves and much other information including a brief outline of thorium in Canada. Published as

Mineral Information Bulletin MR 44, this work is obtainable from the Department of Mines and Technical Surveys, Ottawa, price 50 cents.

The Ministry of Labour and Mines of Northern Rhodesia has published the *Records of the Geological Survey for 1959*, available from the Ministry in Lusaka, pp. 79, plus tables, plates and maps, price £1 1s. The areas covered in this publication include the Petauke, Mumbwa, Lusaka and Choma Districts, and other articles, including an examination of a proposed site for a dam near Kafironda siding, Mufulira district.

The Pakistan Bureau of Mineral Resources, have published their first annual report, *Mining Industry in Pakistan, 58* pages, covering their first year's operations in 1959. This report is mainly concerned with the activities of the Petroleum and Mineral Commission, but a brief account is included of the work of the Geological Survey. It is available from the Ministry of Fuel, Power and Natural Resources, Karachi, and reports on the mining of oil, gas, coal, peat chromite and other minerals, and includes tables of production and consumption.

The Geological Survey Department of British Guiana have now published their *Report on the Geological Survey Department for 1959*, which is available from the Department in Georgetown.

During 1959 Canada maintained its position as the world's fifth largest producer of copper, with mines in six provinces and the Northwest Territories, and six smelters and two electrolytic refineries in operation. The Mineral Resources Division of the Department of Mines and Technical Surveys, have published a *Survey of the Copper Industry in Canada, 1959* by A. F. Killin giving detailed information on the sources of primary production, trade and consumption in Canada during the year under review. This publication, 107 pages, may be obtained from the Division in Ottawa, Price 50 cents.

The 42nd issue of the *Pocket Year Book of Western Australia, 1960* compiled by R. J. Little, Deputy Commonwealth and Government Statistician is now available from the Commonwealth Bureau of Census and Statistics, Western Australian Office.

Canada 1960. The latest issue of the official handbook of present conditions and recent progress, is now available, price \$1. Prepared in the Information Services Division, Dominion Bureau of Statistics, this handbook offers a factual, annual survey of the Canadian economy, with statistics of the recent economic, social and cultural development of the nation. It is lavishly illustrated, and portrays the present conditions of the Canadian people, their resources, institutions and way of life.

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